

**Appendix L. Kings Beach Urban  
Improvement Project Traffic  
Report**

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# KINGS BEACH URBAN IMPROVEMENT PROJECT TRAFFIC REPORT

*Prepared for*

Placer County

*Prepared by*

LSC Transportation Consultants, Inc.



January 25, 2007

**Kings Beach**

**Urban Improvement Project**

**Traffic Report**

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## Section 1

# Study Setting and TRPA Code/Significance Criteria

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### 1.1 Existing Setting

The study area is defined as the SR 28 corridor between (and including) Chipmunk Street on the east and SR 267 on the west, including all intersections with public streets within this corridor. To the degree necessary to assess project impacts, other roadway elements (such as residential streets within Kings Beach) are also evaluated. Note that this study area is larger than the proposed urban improvement project area, in order to address impacts and conditions outside of the project area.

The following roadway alternatives were evaluated:

- Alternative 1 – No Project. The existing roadway configuration would be unchanged.
- Alternative 2 – Three-lane cross-section with roundabouts at SR 267, Bear Street, and Coon Street, and no on-street parking during the summer on either side of SR 28.
- Alternative 3 – Four-lane cross-section with traffic signals at SR 267, Bear Street, and Coon Street and on-street parking along both sides of SR 28. Left-turn lanes would be provided on SR 28 at Bear, Coon, and Fox Streets. The roadway would transition from four lanes to three lanes east of Fox Street, providing a three-lane cross-section at Chipmunk Avenue.
- Alternative 4 – Identical to Alternative 2 except that on-street parking would be prohibited over the entire year including the winter.

Under all alternatives (except Alternative 1), Brook Avenue from Bear Street to Coon Street would be converted to one-way eastbound. In addition to the review of existing traffic conditions, two design years are considered: a “near term” year which corresponds to the first year of project implementation assumed to be 2008, and a “long term” 20 years in the future (2028).

This discussion presents the criteria against which traffic conditions are measured. The future conditions under the four “build” alternatives are then compared against the criteria to identify the impacts of the alternatives on traffic circulation and pedestrian mobility. Potential mitigation, minimization, and avoidance measures are evaluated in Section 4.

### 1.2 Significant Criteria

The following criteria have been applied in this traffic study.

- The Tahoe Regional Planning Agency (TRPA) standard is to achieve Level of Service (LOS) D or better at signalized intersections, with up to four hours per day at LOS E allowed. In summer, traffic volumes on SR 28 in Kings Beach vary over the day such that volumes on the 5th-highest hour are frequently within 10 percent of the peak volume, indicating that LOS E conditions could exist during more than four hours if the peak hour LOS is E. For summer conditions, therefore, a peak hour LOS of D is applied in the summer. However, the hourly winter traffic data indicates that the 5th-highest hourly volume is well below the peak hour volumes; therefore, a peak hour LOS of E is used in this study as the standard for winter conditions. While TRPA does not have specific standards for

roundabouts, the TRPA LOS standards for signalized intersections are assumed to apply. TRPA has no standards specific to unsignalized intersections, though intersection approaches with LOS F conditions are typically considered to be a concern by TRPA staff (Bridget Cornell, TRPA, personal conversation). Roadway traffic volumes providing LOS F conditions in any one hour or more than four hours per day of LOS E conditions (between 90 percent and 100 percent of roadway capacity) will be considered to exceed standards.

- Caltrans roadway standards are identified in a *State Route 28 Transportation Concept Report* (Caltrans District 3, 1997). The “concept LOS” identified for SR 28 is LOS F. As the TRPA standards are more restrictive than this level, the TRPA standards are pertinent to this study.
- Placer County Department of Public Works has indicated that the maximum traffic volume along a largely residential local street (like the majority of Kings Beach’s “internal” streets) to be 2,000 to 3,000 vehicles per day for streets serving residential zoning of one-fourth acre or less with front-on lotting. While lots in Kings Beach were originally laid out to front on the east-west streets, housing has developed that fronts onto every north-south street as well. Considering the narrow pavement width, density of development, lack of sidewalks, and necessity for pedestrians in winter to walk in the travel lanes, a standard of significance of 3,000 vehicles per day is considered for local streets in Kings Beach for purposes of this analysis.
- *The California Manual on Uniform Traffic Control Devices* (MUTCD), (Caltrans, September 26, 2006) signal warrants are used to assess the appropriateness of the traffic control devices (either signal or roundabout) proposed in the two alternatives. If it is determined based upon all available information and forecasts that a traffic control device is proposed at a location that does not meet minimum signal warrants, this would be considered to be a significant impact. Locations where warrants are met, but a traffic control device is not proposed are not considered to be a significant impact, as the MUTCD indicate that meeting warrants do not require a traffic control device.

## Section 2

# Affected Environment

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### 2.1 Affected Roadways

Roadways in the study area can be characterized as follows:

- State Route 28 is the major roadway serving Lake Tahoe's North Shore, linking Kings Beach with Incline Village, Nevada to the east, and Tahoe Vista and Tahoe City to the west. In the vicinity of the site, SR 28 is a four-lane facility with two lanes of travel in each direction. East of Kings Beach and west of Tahoe Vista, SR 28 is a two-lane facility. The posted speed limit on this segment of SR 28 is 30 miles per hour.
- State Route 267 is a two-lane highway running in a general northwest-southeast alignment between Interstate 80 in Truckee and State Route 28 in Kings Beach. This highway consists of two travel lanes, with a speed limit of 55 miles per hour in the rural sections.
- Local streets in the Kings Beach area consist of a grid of north-south streets mostly named after mammals (such as Chipmunk Street, Fox Street, Coon Street, Bear Street, and Deer Street) intersected by east-west streets mostly named after fish species (such as Speckled Avenue, Dolly Varden Avenue, Trout Avenue, and Brook Avenue). These Placer County roadways all provide a single travel lane in each direction.

Traffic control at intersections in Kings Beach is currently provided by Stop signs on side street approaches, with the exception of traffic signals located at the SR 28/SR 267 and the SR 28/Coon Street intersections. The only dedicated turn lanes consist of eastbound and westbound left-turn lanes and a southbound right-turn lane at the SR 28/SR 267 intersection. A map depicting the area roadways is presented in Figure 1.

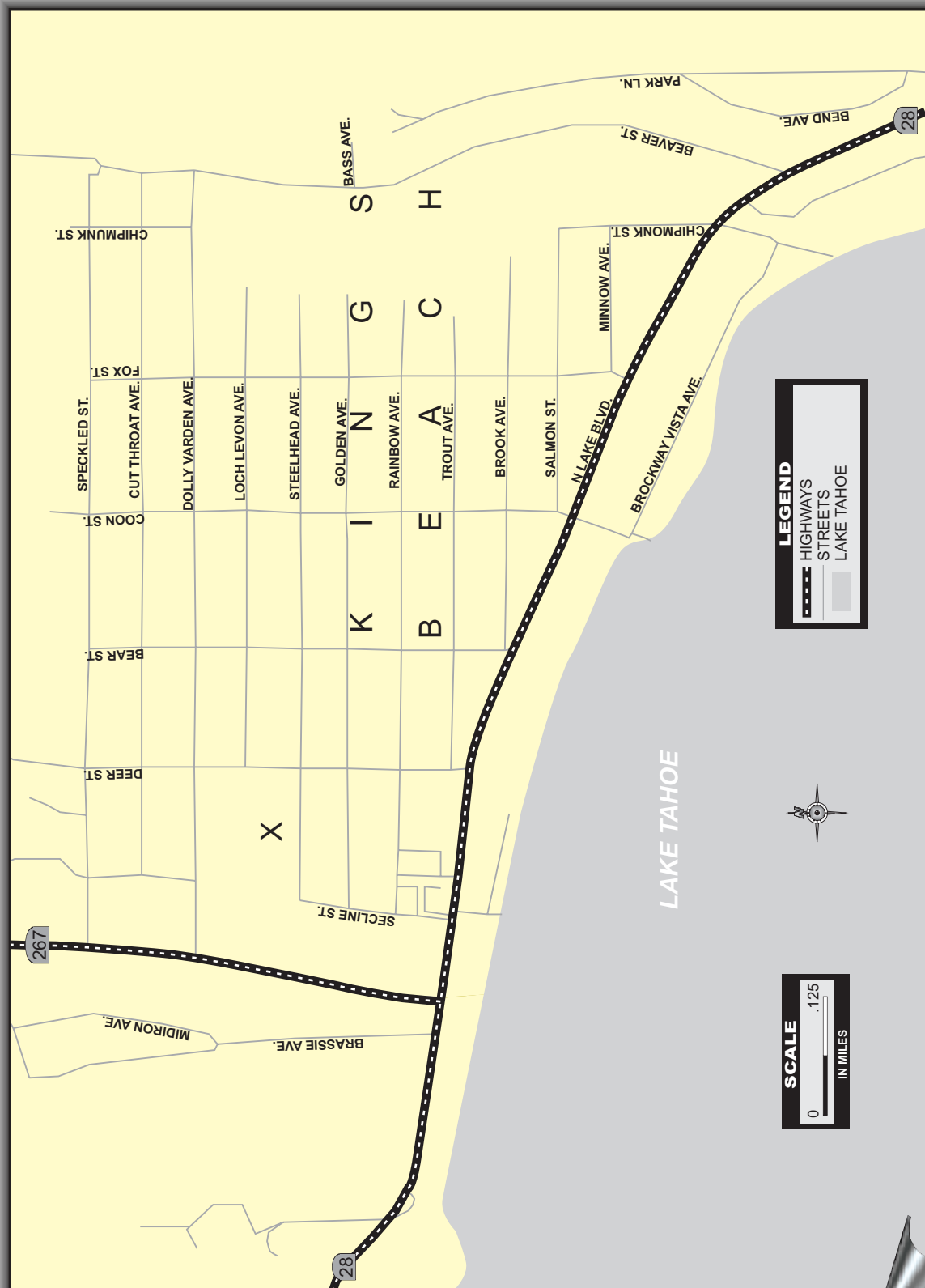
### 2.2 Existing Traffic Data

#### **Historical Traffic Volumes**

Historical traffic volumes along SR 28 near the study area were obtained from *Traffic Volumes on California State Highways* (Caltrans, 1992-2002), and are presented in Table 1. A review of this table yields the following conclusions:

- Annual Average Daily Traffic (AADT) volumes have increased at a rate higher than the Peak Month Average Daily Traffic (PMADT) volumes in the area. The peak month of traffic in the study area typically occurs in July. On SR 28 between SR 267 and Coon Street, AADT increased by 2,000 vehicles between 1992 and 2002, while PMADT volumes actually declined by 100.
- While this drop in PMADT is reported for SR 28 west of Coon Street, for the segment of SR 28 to the east of Coon Street, PMADT increased by 600 vehicles per day between 1992 and 2002.
- Except for SR 28 east of SR 267 and SR 267 over Brockway Summit, peak hour traffic volumes were reported to decline on the state highways between 1992 and 2002.

FIGURE 1  
KINGS BEACH COMMERCIAL CORE STUDY AREA



<b>TABLE 1: 1992-2002 Caltrans Traffic Counts on State Routes in Kings Beach Area</b>										
Route Location	1992 Two-Way Traffic Volumes			2002 Two-Way Traffic Volumes			Annual 1992-2002 Change			
	Average Annual Daily	Peak Month Avg. Daily	Peak Hour	Average Annual Daily	Peak Month Avg. Daily	Peak Hour	Average Annual Daily	Peak Month Avg. Daily	Peak Hour	Peak Hour
28 West of SR 267 in Tahoe Vista	16,800	23,900	2,200	18,100	23,700	2,250	0.75%	-0.08%	0.22%	
28 East of SR 267 in Kings Beach	17,100	24,200	2,100	19,100	24,100	2,050	1.11%	-0.04%	-0.24%	
28 East of Coon St. in Kings Beach	13,200	18,800	1,700	15,100	19,400	1,650	1.35%	0.31%	-0.30%	
267 South of Northstar Drive	6,700	8,800	920	8,100	9,900	1,150	1.92%	1.18%	2.26%	
267 North of North Avenue	7,800	10,500	1,000	8,500	10,800	800	0.86%	0.28%	-2.21%	
267 North of SR 28	8,000	11,100	1,000	9,200	11,900	880	1.41%	0.70%	-1.27%	
Source: Caltrans web site, and 1992 Traffic Volumes on California State Highways.										

Traffic data for years prior to 1992 is also useful in providing a context to traffic issues in the community. Caltrans District 3 data for the peak month average daily total traffic volume counts for SR 28 to the east of SR 267 indicates that volumes were 18,100 in 1970, 20,500 in 1975, 29,000 in 1980, 23,700 in 1985, and 24,100 in 2002. This data indicates that current volumes are roughly 17 percent below the peak recorded volumes, which occurred in 1980.

### **Summer 2002 SR 28 Hourly Count Data**

Summer traffic volume data along SR 28 was collected from the Caltrans count station located on SR 28 just to the east of SR 267. Hourly counts were conducted in both directions from June 2, 2002 through September 30, 2002, as presented in full in Appendix A. The data indicates that the summer season occurs from roughly Friday, June 14, 2002 through Sunday, September 15, 2002.

A summary of total daily traffic volumes recorded at this location is presented in Table 2 and depicted in Figure 2. As shown, there is a strong weekly variation in traffic volumes, with the highest traffic volumes typically observed on Saturdays or Sundays, and the lowest volumes observed on Monday or Wednesday. The highest total traffic volumes were recorded on Friday, July 5th, with a total two-direction traffic volume of 32,708. Traffic activity then falls before a second peak period the first few weeks of August, after which volumes generally decline except for a spike around Labor Day weekend. The peak month (August) average daily traffic volume was reported to be 25,179.

To provide a basis for analysis of hourly peak traffic conditions, it is useful to examine hourly directional traffic volumes over a busy summer weekend period. As depicted in Figure 3, there is a strong eastbound traffic flow on Friday afternoon/evening, which can be assumed to consist largely of drivers traveling to Incline Village for the weekend. Volumes on Saturday reach high levels between roughly 10:00 AM and 6:00 PM, with slightly higher volumes in the westbound direction than the eastbound direction (this imbalance is also found at other locations across the North Shore). On Sunday, there is a strong midday peak in traffic volumes in the westbound direction, which probably largely reflects motorists leaving the Incline Village area at the end of the weekend.

This hourly count data is also very useful for purposes of this study to evaluate the distribution of the number of hours per summer season that experience various levels of traffic activity. Table 3 and Figure 4 present a summary of the number of hours per summer by traffic activity level, aggregated into ranges of 100. Not surprisingly, the largest proportion of hours (the middle of the night period) has traffic volumes of less than 100 vehicles per hour. At the opposite extreme, traffic volumes fall between 1,300 and 1,400 vehicles per hour for a total of five hours (four hours in the eastbound direction, and one hour in the westbound direction).

This data can also be evaluated to identify various potential design volume levels, as shown in Table 4. While roadway facilities are typically designed based upon the 30th-highest volumes, other levels of relatively high traffic activity are also provided as a basis for comparison. As indicated, the 30th-highest volumes are roughly 83 percent to 87 percent of the peak observed volumes (for eastbound and westbound directions, respectively).

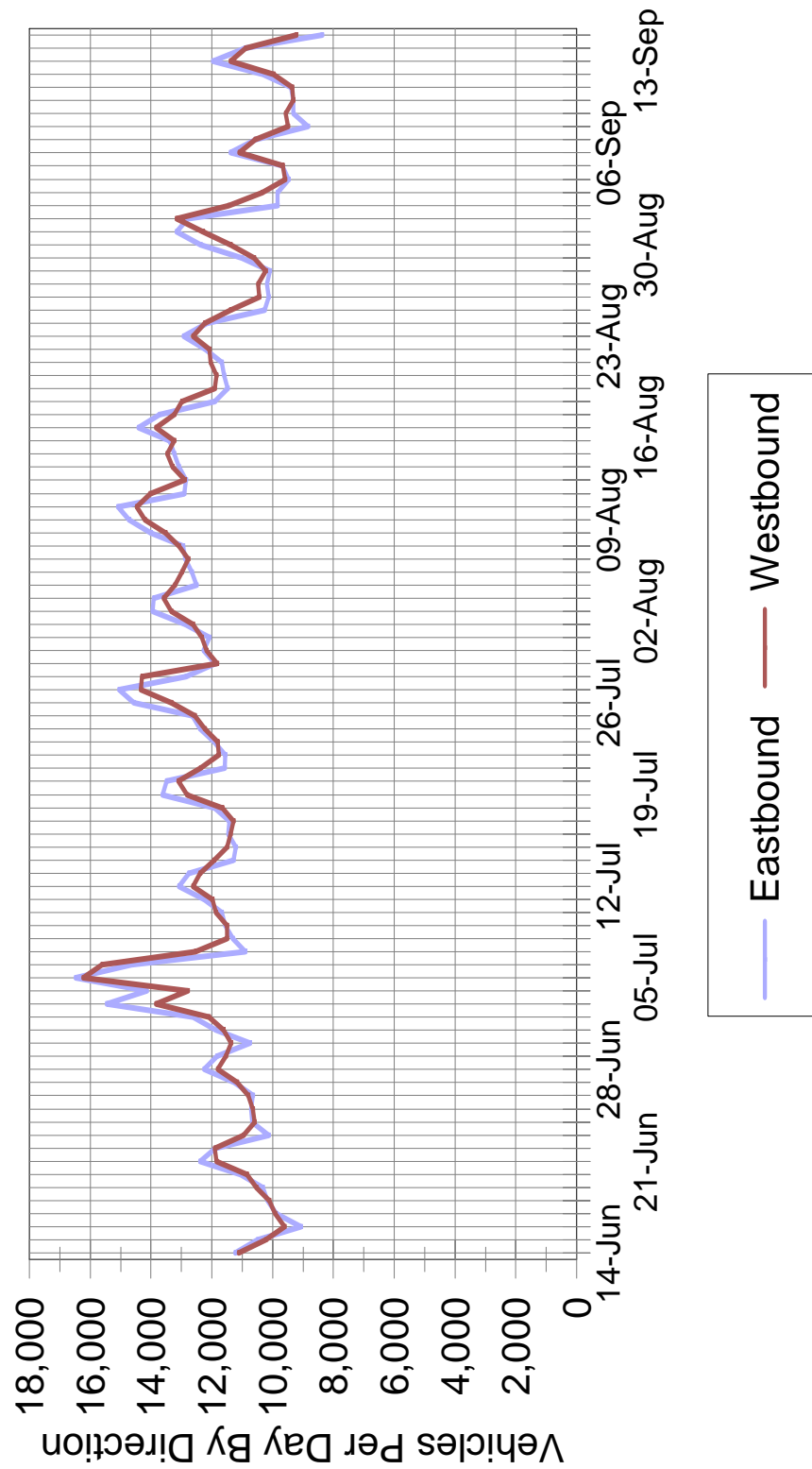
### **Winter 2003 Caltrans Count Data**

Data (though for a more limited period) is also available from Caltrans counts for winter conditions on SR 28 east of SR 267. A summary of peak hour volumes observed for each day in January 2003 is presented as Table 5. A review of this data indicates that the peak eastbound volumes are comparable to the summer 30th-highest volumes, though busy westbound volumes are substantially lower in winter than in summer.

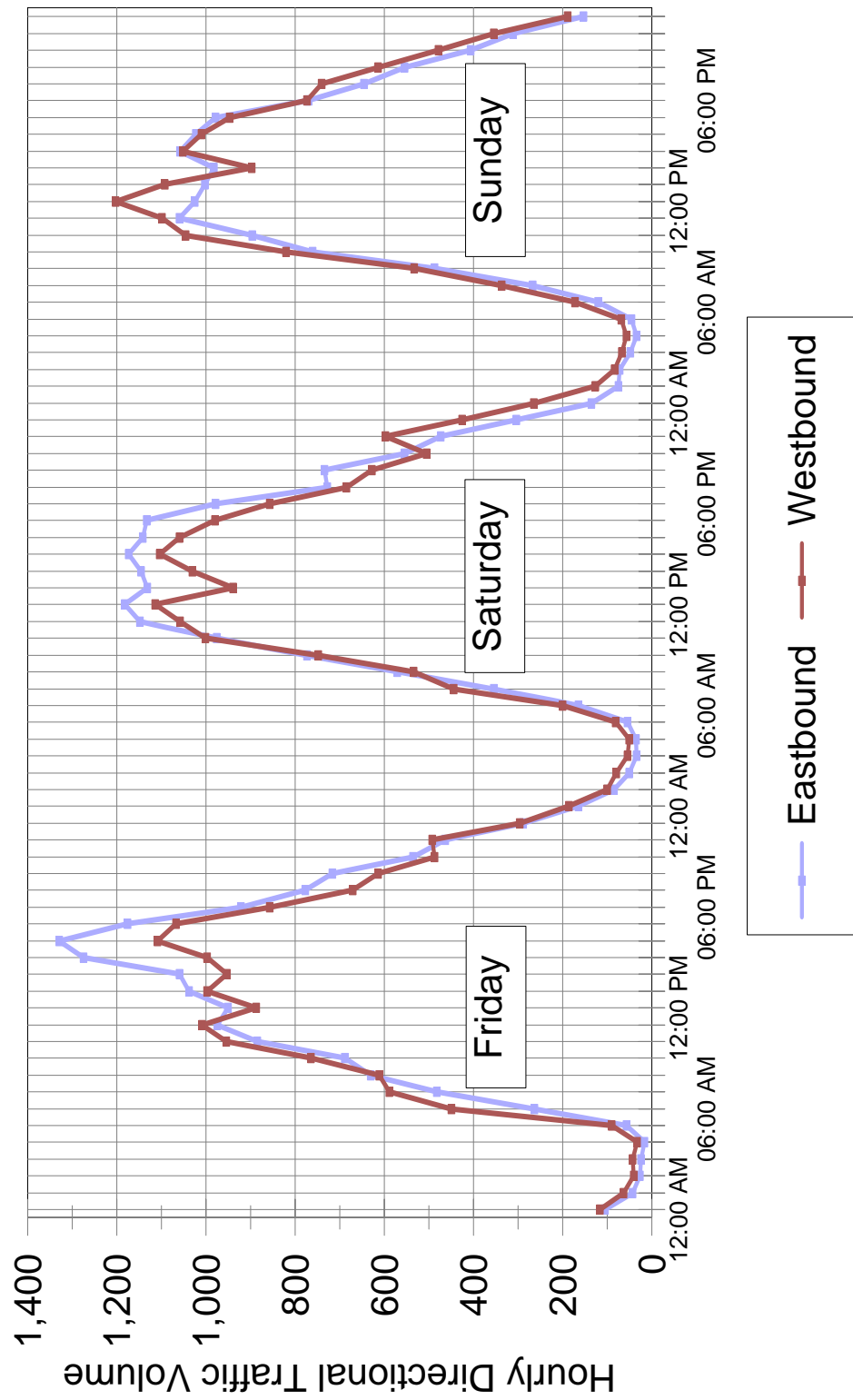
**TABLE 2: Daily 2002 Traffic Volume on SR 28 East of SR 267**

	Eastbound	Westbound	Total		Eastbound	Westbound	Total
14-Jun Fri	11,234	11,108	22,342	01-Aug Thu	12,877	12,620	25,497
15-Jun Sat	10,486	10,217	20,703	02-Aug Fri	13,947	13,331	27,278
16-Jun Sun	9,068	9,614	18,682	03-Aug Sat	13,917	13,589	27,506
17-Jun Mon	9,880	9,916	19,796	04-Aug Sun	12,498	13,220	25,718
18-Jun Tue	10,168	10,113	20,281	05-Aug Mon	12,653	12,986	25,639
19-Jun Wed	10,323	10,535	20,858	06-Aug Tue	12,875	12,771	25,646
20-Jun Thu	11,046	10,849	21,895	07-Aug Wed	12,941	13,086	26,027
21-Jun Fri	12,377	11,844	24,221	08-Aug Thu	14,006	13,517	27,523
22-Jun Sat	11,881	11,896	23,777	09-Aug Fri	14,725	14,190	28,915
23-Jun Sun	10,126	10,967	21,093	10-Aug Sat	15,095	14,460	29,555
24-Jun Mon	10,668	10,596	21,264	11-Aug Sun	12,909	14,026	26,935
25-Jun Tue	10,706	10,645	21,351	12-Aug Mon	12,856	12,891	25,747
26-Jun Wed	10,643	10,801	21,444	13-Aug Tue	13,086	13,299	26,385
27-Jun Thu	11,258	11,167	22,425	14-Aug Wed	13,239	13,460	26,699
28-Jun Fri	12,253	11,802	24,055	15-Aug Thu	13,397	13,236	26,633
29-Jun Sat	11,836	11,536	23,372	16-Aug Fri	14,405	13,827	28,232
30-Jun Sun	10,750	11,366	22,116	17-Aug Sat	13,722	13,244	26,966
01-Jul Mon	11,864	11,606	23,470	18-Aug Sun	11,911	12,985	24,896
02-Jul Tue	12,609	12,101	24,710	19-Aug Mon	11,484	11,895	23,379
03-Jul Wed	15,444	13,833	29,277	20-Aug Tue	11,593	11,840	23,433
04-Jul Thu	14,136	12,786	26,922	21-Aug Wed	11,670	12,033	23,703
05-Jul Fri	16,478	16,230	32,708	22-Aug Thu	12,216	12,070	24,286
06-Jul Sat	14,642	15,610	30,252	23-Aug Fri	12,924	12,614	25,538
07-Jul Sun	10,892	12,545	23,437	24-Aug Sat	12,156	12,230	24,386
08-Jul Mon	11,296	11,499	22,795	25-Aug Sun	10,258	11,385	21,643
09-Jul Tue	11,553	11,492	23,045	26-Aug Mon	10,125	10,432	20,557
10-Jul Wed	11,663	11,863	23,526	27-Aug Tue	10,190	10,477	20,667
11-Jul Thu	12,247	11,975	24,222	28-Aug Wed	10,097	10,232	20,329
12-Jul Fri	13,084	12,614	25,698	29-Aug Thu	11,019	10,606	21,625
13-Jul Sat	12,744	12,386	25,130	30-Aug Fri	12,376	11,389	23,765
14-Jul Sun	11,278	11,918	23,196	31-Aug Sat	13,153	12,286	25,439
15-Jul Mon	11,205	11,489	22,694	01-Sep Sun	12,789	13,152	25,941
16-Jul Tue	11,457	11,382	22,839	02-Sep Mon	9,833	11,438	21,271
17-Jul Wed	11,419	11,288	22,707	03-Sep Tue	9,844	10,350	20,194
18-Jul Thu	11,912	11,660	23,572	04-Sep Wed	9,465	9,581	19,046
19-Jul Fri	13,628	12,812	26,440	05-Sep Thu	9,682	9,674	19,356
20-Jul Sat	13,489	13,101	26,590	06-Sep Fri	11,378	11,092	22,470
21-Jul Sun	11,571	12,376	23,947	07-Sep Sat	10,561	10,580	21,141
22-Jul Mon	11,564	11,773	23,337	08-Sep Sun	8,834	9,495	18,329
23-Jul Tue	11,931	11,816	23,747	09-Sep Mon	9,314	9,560	18,874
24-Jul Wed	12,392	12,222	24,614	10-Sep Tue	9,315	9,324	18,639
25-Jul Thu	12,628	12,560	25,188	11-Sep Wed	9,391	9,355	18,746
26-Jul Fri	14,561	13,336	27,897	12-Sep Thu	10,315	9,967	20,282
27-Jul Sat	15,048	14,342	29,390	13-Sep Fri	11,954	11,391	23,345
28-Jul Sun	12,855	14,302	27,157	14-Sep Sat	10,898	10,886	21,784
29-Jul Mon	11,876	11,819	23,695	15-Sep Sun	8,379	9,217	17,596
30-Jul Tue	12,263	12,171	24,434				
31-Jul Wed	12,078	12,328	24,406				

**Figure 2**  
**One-Way Daily Traffic Volumes on SR 28**  
**East of SR 267**



**Figure 3**  
**One-Way Hourly Traffic Weekend Volumes**  
 SR 28 East of SR 267, for Friday August 9 through Sunday August 11

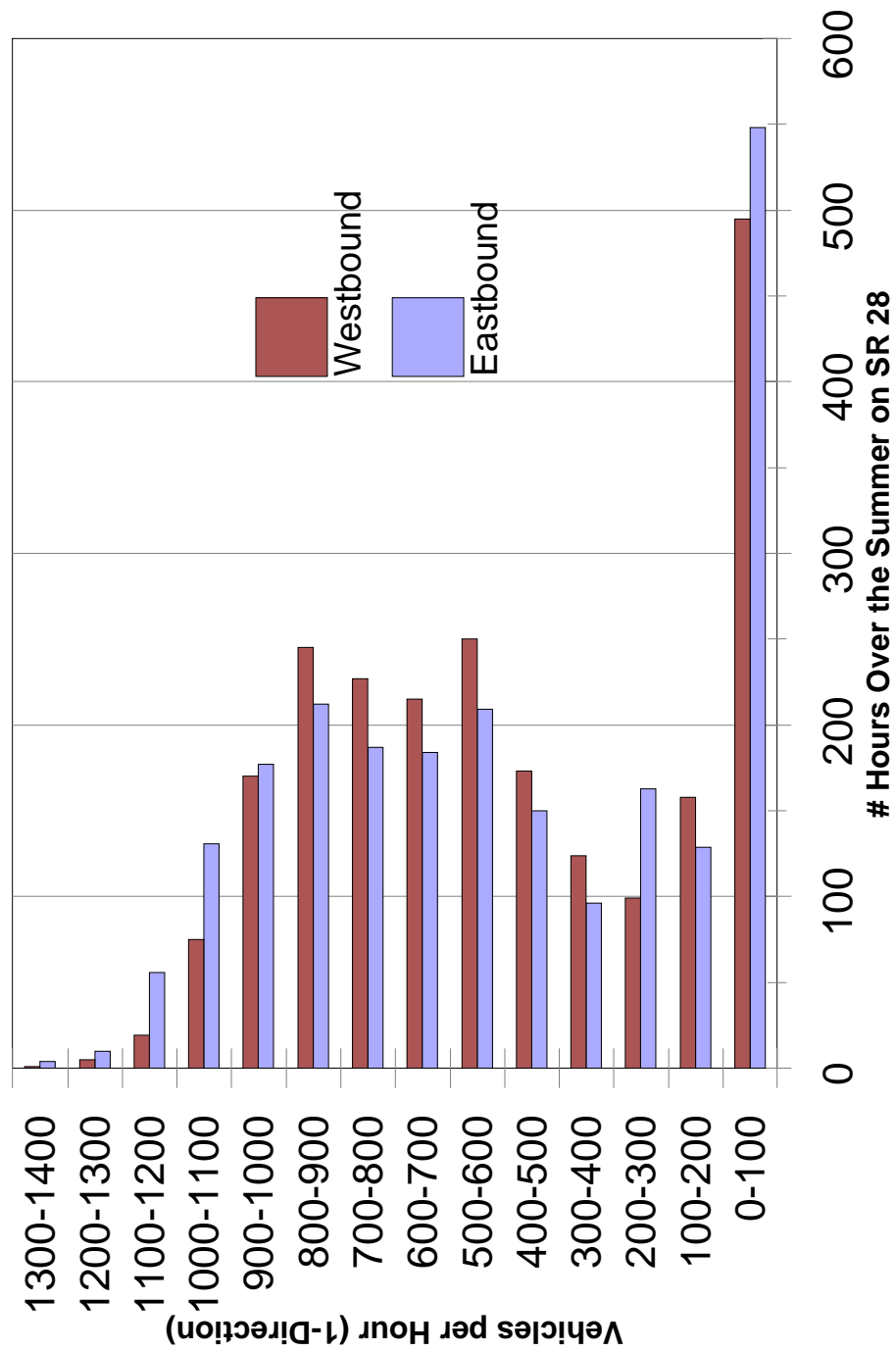


**TABLE 3: Number of Summer Hours of Traffic Activity on SR 267 by Traffic Volume  
In Hundred Increments**

For June 14, 2002 Through September 14, 2002  
For Count Location on SR 28 Just East of SR 267 in Kings Beach

Hourly Traffic Volume Between	And	Eastbound			Westbound		
		Number of Hours in Volume Range	Number of Hours with Volume Less Than Upper End of Range	% of Hours With Volume Less Than Upper End of Range	Number of Hours with Volume Less Than Upper End of Range	Number of Hours in Volume Range	% of Hours With Volume Less Than Upper End of Range
0	100	548	548	24.29%	495	495	21.95%
100	200	129	677	30.03%	653	653	28.96%
200	300	163	840	37.24%	752	752	33.35%
300	400	96	936	41.51%	876	876	38.85%
400	500	150	1,086	48.14%	1,049	1,049	46.52%
500	600	209	1,295	57.42%	1,299	1,299	57.56%
600	700	184	1,479	65.58%	1,514	1,514	67.10%
700	800	187	1,666	73.87%	1,741	1,741	77.16%
800	900	212	1,878	83.24%	1,986	1,986	88.03%
900	1,000	177	2,055	91.08%	2,156	2,156	95.59%
1,000	1,100	131	2,186	96.89%	2,231	2,231	98.90%
1,100	1,200	56	2,242	99.37%	2,250	2,250	99.71%
1,200	1,300	10	2,252	99.82%	2,255	2,255	99.96%
1,300	1,400	4	2,256	100.00%	2,256	2,256	100.00%

**Figure 4**  
**# Summer Hours by Traffic Volume on 28**



**TABLE 4: Traffic Volume Distribution on SR 28  
East of SR 267**

Summer, 2002 Caltrans Counts

Volume Level	Westbound		Eastbound	
	Volume	% of Peak	Volume	% of Peak
Peak	1,332	--	1,329	--
10th-Highest	1,200	90.09%	1,240	93.30%
30th-Highest	1,100	82.58%	1,160	87.28%
100th-Highest	1,000	75.08%	1,060	79.76%

This data indicates that the peak hour occurred on Friday, January 3rd, between 4:00 PM and 5:00 PM, when a total of 2,124 vehicles were observed (1,174 eastbound and 950 westbound). Traffic volumes over the course of this entire day (22,864) are actually the 2nd-highest level, roughly 5 percent below the daily traffic volumes of Thursday, January 2nd. On January 2nd, however, total two-way peak hour traffic (2,037) was roughly 4 percent lower than on January 3rd. As traffic congestion and air emissions increase rapidly with increased peak hour traffic, the winter analysis focuses on the January 3rd data.

### **SR 28 Intersection Turning Movement Volumes**

Table 6 presents the most recent available peak summer and winter season intersection turning movement counts for the public street intersections in the study area. Summer counts were most recently conducted by Caltrans staff in the late 1990s. In addition, a winter count was conducted by LSC staff at SR 28/SR 267 in January, 2003 as part of this study. The winter count reflects peak Saturday traffic when ski traffic into Kings Beach and Incline Village is at its greatest level. Total traffic volumes through the SR 267/SR 28 intersection during the winter peak hour was 93 percent of the volumes observed during the summer peak hour. In addition, the roadway volume on SR 28 east of SR 267 during this busy winter peak hour corresponds to the 88th percentile level of summer traffic volumes (as shown in Table 3).

#### Summer Volumes

Using the Caltrans hourly directional counts for SR 28 just east of SR 267, it is possible to adjust these observed counts to reflect a specific existing design level. *A Policy on Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials, 2001) indicates that “The design hourly volume for rural highways . . . should be generated by the 30<sup>th</sup>-highest volume of the future year chosen for design” (page 61). As this traffic level corresponds closely with peak hour volumes observed on a busy Saturday in August, the peak hour of a busy Saturday in August was used as the summer analysis period for this study.

Specifically, the SR 28/267 volumes shown in Table 6 were adjusted to match the 30th-highest hourly roadway volumes presented in Table 4. Exiting volumes were then balanced against the entering volumes

**TABLE 5: Winter Peak Hour Traffic Data***SR 28 East of SR 267*

Day of Week	AM Pk-HR	AM Pk-HR	PM Pk-HR	PM Pk-HR
	EB	WB	EB	WB
01-Jan-03 WED	735	925	946	893
02-Jan-03 THURS	800	1005	1158	924
03-Jan-03 FRI	664	891	1174	950
04-Jan-03 SAT	573	778	939	752
05-Jan-03 SUN	454	650	748	592
06-Jan-03 MON	527	621	861	704
07-Jan-03 TUES	507	566	945	718
08-Jan-03 WED	488	602	941	670
09-Jan-03 THURS	571	581	821	619
10-Jan-03 FRI	516	538	910	688
11-Jan-03 SAT	562	576	805	565
12-Jan-03 SUN	404	592	593	553
13-Jan-03 MON	484	572	783	663
14-Jan-03 TUES	497	554	868	645
15-Jan-03 WED	487	564	913	678
16-Jan-03 THURS	509	591	943	660
17-Jan-03 FRI	575	624	1124	773
18-Jan-03 SAT	659	624	1050	749
19-Jan-03 SUN	581	781	867	730
20-Jan-03 MON	528	877	863	794
21-Jan-03 TUES	509	566	738	621
22-Jan-03 WED	466	541	821	645
23-Jan-03 THURS	515	518	754	666
24-Jan-03 FRI	540	572	963	717
25-Jan-03 SAT	595	641	940	720
26-Jan-03 SUN	490	666	720	607
27-Jan-03 MON	483	617	709	657
28-Jan-03 TUES	497	534	839	706
29-Jan-03 WED	457	553	769	697
30-Jan-03 THURS	465	562	825	681
31-Jan-03 FRI	563	578	1101	753

Source: Caltrans

**TABLE 6: Available Intersection Peak Hour Traffic Counts**

TABLE 6: Available Intersection Peak Hour Traffic Counts																
SR 28 @	Date	Day of Wk	Hr Beginning	Southbound			Westbound			Northbound			Eastbound			TOTAL
				Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
<b><u>Summer</u></b>																
267	08/19/98	Wednesday	05:00 PM	252	1	196	2	476	298	1	0	2	150	651	1	2,030
Secline	07/31/99	Saturday	12:00 PM	38	2	16	22	979	33	22	1	20	43	1144	11	2,331
Deer	08/21/99	Saturday	11:15 AM	3	0	23	23	1017	21	0	0	4	28	946	12	2,077
Bear	07/10/99	Saturday	03:45 PM	8	0	77	37	827	40	11	0	57	46	814	49	1,966
Coon	NA	NA	NA	111	27	70	32	893	33	31	7	33	69	900	77	2,283
Fox	08/21/99	Saturday	03:00 PM	34	3	42	3	756	60	0	0	0	51	1036	0	1,985
Chipmunk	NA	NA	NA	23	0	14	--	996	18	--	--	--	40	1049	--	2,140
<b><u>Winter</u></b>																
267	01/04/03	Saturday	04:30 PM	367	5	209	2	388	261	1	0	1	135	519	0	1,888
Source of Summer Counts: Caltrans District 3																
Source of Winter Counts: LSC																

at the next intersection to the east. In addition, PM peak hour roadway volumes collected by Placer County on SR 28 just east of Fox Street for the period from July 24, 2002 through July 29, 2002 were compared with the Caltrans counts just east of SR 267 for the same period to identify the 30th-highest hourly volumes between Fox and Chipmunk Streets. Intersection volumes were then adjusted to also match these volumes east of Fox Street, reflecting the drop in traffic levels associated with turning movements along SR 28 at private driveways. This impact of driveway traffic between the various intersections was allocated based upon the block-by-block parking demand not served by the public streets. The resulting 30th-highest Summer 2002 intersection turning movements are presented in Table 7.

### Winter Volumes

Using the Caltrans hourly directional counts for SR 28 just east of SR 267, it is possible to adjust the observed count shown in Table 6 to reflect the highest winter traffic volumes. As winter intersection turning movement volumes were not available for the intersections other than SR 28/267 and as side street traffic is relatively stable over the course of the year, winter turn proportions onto and off of local streets were assumed to be equal to the summer proportions. The SR 28/267 volumes shown in Table 6 were then adjusted to match the highest hourly roadway volumes presented in Table 5. Exiting volumes were then balanced against the entering volumes at the next intersection to the east. The resulting winter 2003 intersection design turning movements are presented in Table 8.

### **Traffic Volumes on Local Kings Beach Roadways**

In the summer of 2002, Placer County Department of Public Works conducted a series of intersection and road tube traffic counts throughout the county roadway network in Kings Beach. A summary of the intersection peak hour counts are presented in Table 9, while a summary of the road tube counts are presented in Table 10. Intersection counts were generally conducted over a two-hour period on two different days in June, July, or August, while the road tube counts were conducted over a week-long period in late July. In addition, Placer County road tube counts conducted in the late 1990s for Speckled Avenue just east of SR 267 indicate ADT volumes ranging from 461 to 878.

This data (along with the intersection count data along SR 28) was used to plot the peak hour and the total daily traffic volumes, as shown in Figure 5. A review of this count data indicates the following:

- There is little or no evidence of an existing “cut through” traffic pattern between SR 28 and SR 267, as evidenced in particular by the volumes on Speckled Avenue and Dolly Varden Avenue at SR 267. Traffic volumes are typical for the level of land use development served by the internal streets.
- Not surprisingly, traffic volumes on the local streets are highest near SR 267, and particularly near SR 28. Volumes on north-south streets drop substantially north of the first two blocks off of SR 28.
- Coon Street has the greatest traffic activity of any of the local streets, particularly in the southbound direction. This reflects the relative ease of access to SR 28 provided by the existing traffic signal.

### 2.3 Existing Pedestrian/Bicycle Activity Counts

Table 11 presents a summary of available recent summer counts of pedestrian and bicycle activity in the Kings Beach area. As these counts were limited to specific days, they may not reflect actual peak levels of activity. In general, however, the data indicates that pedestrian crossing of SR 28 are highest at Bear Street (with the probable exception of Coon Street, for which no data is available), with 144 pedestrians and 1 cyclist crossing the state highway in the peak observed summer hour.

<b>TABLE 7: 30th-Highest Peak Hour Summer 2002 Intersection Turning Movement Volumes</b>													
SR 28 @	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
267	323	1	264	3	675	422	1	0	3	202	834	1	2,729
Secline	39	2	17	22	1,055	36	24	1	26	42	1,106	11	2,381
Deer	3	0	24	25	1,054	22	0	0	5	33	1,106	14	2,286
Bear	10	0	91	44	973	47	13	0	73	56	986	59	2,352
Coon	113	27	72	33	922	34	32	7	42	69	903	77	2,331
Fox	36	3	50	3	892	71	0	0	0	48	985	0	2,088
Chipmunk	21	0	13	--	909	16	0	--	0	37	961	0	1,957

SR 28 @	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
267	486	6	264	3	566	381	1	0	1	171	687	0	2,566
Secline	36	2	15	21	911	31	20	1	26	42	1,119	11	2,235
Deer	3	0	21	24	907	19	0	0	5	33	1,116	14	2,142
Bear	9	0	78	41	837	40	11	0	74	56	995	60	2,201
Coon	105	27	62	30	791	29	27	7	43	70	910	78	2,179
Fox	33	3	42	3	761	60	0	0	0	48	985	0	1,935
Chipmunk	19	0	11	--	769	14	0	--	0	37	958	0	1,808

**TABLE 9: Kings Beach 2002 Summer Peak Hour Intersection Counts** Conducted by Placer County Staff

N/S Street	E/W Street	Date	Hr Beg	Southbound			Westbound			Northbound			Eastbound			TOTAL
				LT	T	RT	LT	T	RT	LT	T	RT	LT	T	RT	
SR 267	Dolly Varden	08/07/02	12:00 PM	15	481	0	5	0	15	0	428	3	0	0	0	947
Secline Street	Rainbow Ave	08/06/02	03:00 PM	2	14	1	26	2	2	4	27	30	0	1	5	114
Wolf Street	Dolly Varden	06/27/02	12:30 PM	1	0	4	0	0	18	0	0	0	2	17	0	42
Deer Street	Steelhead St	08/05/02	12:45 PM	5	14	6	3	11	0	5	28	4	6	6	10	98
Bear Street	Golden Ave	06/27/02	03:15 PM	3	29	1	4	4	0	4	48	8	2	7	3	113
Coon Street	Speckled Street	06/25/02	02:30 PM	2	3	4	2	10	0	17	3	1	3	16	10	71
Coon Street	Rainbow Street	06/27/02	01:00 PM	2	52	0	1	6	6	7	39	4	22	8	2	149
Fox Street	Cutthroat Ave	08/07/02	03:00 PM	0	12	0	7	6	2	4	14	8	0	6	1	60
Fox Street	Dolly Varden	07/17/02	11:45 AM	0	14	1	1	3	3	3	19	5	3	1	3	56
Fox Street	Loch Levon	07/17/02	03:00 PM	1	24	1	0	2	3	5	21	7	2	4	2	72
Fox Street	Trout Street	08/05/02	03:00 PM	2	50	0	2	1	1	2	48	10	12	1	2	131

Note: Reported volumes are the higher of those observed on two days of counts, with the exception of Wolf/Dolly Varden that was counted on one day only.

**TABLE 10: Placer County DPW Kings Beach 2002 Summer Roadway Volumes**

Street	Location	Date	Day	Total Daily		AM Peak Hour		PM Peak Hour	
				WB	EB	WB	EB	WB	EB
SR 28	West of Fox St.	07/24/02	Wed	10,682	--	682	--	860	--
		07/25/02	Thur	10,776	--	730	--	862	--
		07/26/02	Fri	11,534	--	782	--	892	--
		07/27/02	Sat	12,635	--	913	--	966	--
		07/28/02	Sun	12,726	--	1,094	--	1,134	--
SR 28	East of Fox St	07/29/02	Mon	10,279	--	722	--	810	--
		07/24/02	Wed	--	11,102	--	750	--	960
		07/25/02	Thur	--	11,038	--	751	--	954
		07/26/02	Fri	--	12,782	--	794	--	1,043
		07/27/02	Sat	--	13,399	--	950	--	1,101
Fox St	N of SR 28	07/28/02	Sun	--	11,380	--	844	--	1,009
		07/29/02	Mon	--	10,298	--	712	--	854
		07/24/02	Wed	1,143	264	71	32	126	22
		07/25/02	Thur	1,040	220	66	24	122	21
		07/26/02	Fri	1,075	259	62	23	120	20
		07/27/02	Sat	1,122	271	102	23	101	24
		07/28/02	Sun	925	201	63	15	90	23
Source: Placer County DPW									

## FIGURE 5



**TABLE 11: Summary of Available Summer Bicycle and Pedestrian Counts Along SR 28**

SR 28 @	Date	Day of Wk	Hr Beginning	Source	East Side		North Side		West Side		South Side	
					Ped	Bike	Ped	Bike	Ped	Bike	Ped	Bike
Secline	07/31/99	Saturday	12:00 PM	Caltrans	19	1	1	1	--	--	71	29
Deer	08/21/99	Saturday	11:15 AM	Caltrans	35	--	47	--	23	--	36	--
Bear	07/10/99	Saturday	03:45 PM	Caltrans	44	0	44	19	100	1	20	1
Coon	07/10/99	Saturday	01:00 PM	Caltrans	45	--	--	--	55	--	--	--
Fox	08/21/99	Saturday	03:00 PM	Caltrans	42	4	38	4	2	0	--	--
Bear	06/20/02	Thursday	12:30 PM	Placer Co	Total Crossing 28 In 1/2 Block Either Side of Bear = 130 Pedestrians + 12 Bicyclists							

Pedestrian and bicycle activity counts in the Kings Beach area conducted over the 2004/05 Christmas/New Year period, as shown in Table 12, indicate that pedestrian volumes crossing SR 28 are relatively low, with no more than 5 pedestrians per hour crossing at any one intersection, and up to 11 pedestrians per hour crossing mid-block along any one block. Winter pedestrian activity along SR 28 was highest at Coon Street, with 27 pedestrians walking along the north side of the highway and 2 along the south side. Bicycle activity was also relatively low in the winter, with a maximum of three cyclists per hour observed along any one block.

**TABLE 12: Summary of Winter Pedestrian and Bicycle Hourly Counts Along SR 28**

Cross Street	#' of Pedestrians Crossing Each Leg				# of Peds Crossing SR 28 Midblock in Block To East	Number of Bicycles Along SR 28	
	West	East	North	South		North Side	South Side
SR 267	2	0	17	0	0	1	0
Secline	1	3	16	3	5	2	1
Deer	1	1	24	0	3	2	0
Bear	3	1	17	0	0	1	0
Coon	2	3	27	2	0	3	0
Fox	3	1	18	0	11	1	0
Chipmunk	1	0	8	2	0	1	0

Source: Counts conducted by LSC during midday periods between December 27 and December 29, 2004.

#### 2.4 Existing Intersection Level of Service

The data presented above can be analyzed using the Highway Capacity Software programs to identify the existing Level of Service (LOS) at the various intersections. “LOS” is measured on a scale of LOS A (free-flow conditions with little or no delay) to LOS F (stop-and-go congestion); more detailed descriptions of the individual levels of service are provided in Appendix B.

As indicated in Table 13, the existing signalized SR 267/SR 28 intersection operates at an adequate LOS of C in the summer design period, while the SR 28/Coon Street intersection operates at LOS B. Table 14 also provides this information, and a comparison with LOS under the various alternatives. The unsignalized Secline, Bear, Fox, and Chipmunk Street intersections, however, operate at LOS F for the worst movement (the side street approaches to SR 28), while this worst approach operates at LOS D at Deer Street and LOS E at Chipmunk Street. (Where separate turn lanes are provided, a “movement” indicates a specific turning movement such as southbound left-turns, while an “approach” considers all movements on a specific leg, such as the southbound approach). All Highway Capacity Software outputs for the various LOS calculations are presented in Appendix C.

In winter, the existing signalized SR 267/SR 28 intersection operates at an adequate LOS of D in the winter design period while the SR 28/Coon Street intersection operates at LOS A, as shown in Table 15. However, the unsignalized Secline, Bear, and Fox Street intersections operate at LOS F for the worst movement (the side street approaches to SR 28), while this worst approach operates at LOS C at Deer Street and LOS D at Chipmunk Street.

<b>TABLE 13: Existing Summer Design Peak Hour Intersection LOS</b>					
SR 28 @	Existing Traffic Control	Worst Approach		Total Intersection	
		Delay (s/veh)	LOS	Delay (s/veh)	LOS
SR 267	Signal	—	—	27.5	C
Secline Street (1)	Two-Way Stop Controlled	536.0	F	—	—
Deer Street	Two-Way Stop Controlled	27.5	D	—	—
Bear Street (1)	Two-Way Stop Controlled	169.0	F	—	—
Coon Street	Signal	—	—	10.1	B
Fox Street	Two-Way Stop Controlled	178.7	F	—	—
Chipmunk Street	Two-Way Stop Controlled	41.4	E	—	—
<i>Note 1: Although the none of the minor street southbound approaches are striped with separate right-turn lanes, the southbound approaches to the Secline and Bear intersections are wide and used as if there are separate right-turn lanes. Therefore, the LOS at these two intersections was calculated assuming separate right-turn lanes on the southbound approaches.</i>					

## 2.5 Existing Traffic Safety

Table 16 presents a summary of accident history along SR 28 in Kings Beach for a 8.75-year period (April 1, 1996 through December 31, 2004). Per standards of the Caltrans Headquarters Highway Safety Investigations Branch, accidents within 250 feet of an intersection are assigned to the intersection. As indicated, a total of 259 accidents were recorded over this period, of which 70 resulted in injuries, 1 resulted in a fatality, and the remainder resulted in property damage only. The highest number of accidents occurred at the SR 28/Deer Street intersection (44 total accidents, or an average of 4.9 accidents per year), followed by 36 at the SR 28/Fox Street intersection, 35 at the SR 28/Secline Street intersection and 34 at the SR 28/SR 267 intersection. For the roadway segments away from the intersections, the segment of SR 28 between Secline Avenue and Deer Street had the highest number of accidents (11). By type, the largest proportion were broadside accidents (90), which is a relatively hazardous type of accident, followed by rear-end accidents (78) and sideswipes (40). Fourteen pedestrian accidents were recorded, including the single fatality, and 8 bicycle accidents.

Accident rates for intersections are compared by dividing the number of accidents by the estimated total Million Vehicle (MV) movements over the data period, while accident rates for roadway segments are compared by dividing the number of accidents by the estimate total Million Vehicle Miles (MVM). As shown in the table, the intersection accident rates are relatively high for the SR 28/Deer and SR 28/Secline intersections. Roadway segment accident rates are relatively high between Secline and Deer, and between Coon and Fox. Finally, these rates can be compared against California statewide averages for similar types of intersections in rural areas, as presented in *2003 Collision Data on California State Highways* (Caltrans, 2005). As indicated in the right-most portion of the table, the two signalized intersections at SR 28/SR 267 and at SR 28/Coon Street had relatively low rates, at 69 percent and 66 percent the statewide average, respectively. However, accident rates (both total and injury) exceed the statewide average at all roadway segments and other intersections. For injury and fatal accidents, the statewide average is exceeded at the SR 28 intersections at Secline, Deer, and Fox, and along the segment between Coon and Fox. In particular, the total rate at the Deer Street and Fox Street intersections exceed the statewide average by at least a factor of 3. While some of this increased rate can be attributed to snow conditions (as the majority of intersections statewide are below the snow line), the greater factors are probably excessive speeding and the difficulties of judging an acceptable gap in traffic on a four-lane roadway in high volume conditions.

**TABLE 14: Summary of Alternative Traffic Impacts**

			2008				2028			
			Alt 1 - No Project	Alt 2	Alt 3	Alt 4	Alt 1 - No Project	Alt 2	Alt 3	Alt 4
Existing										
<b>SR 28 Summer Intersection LOS (1)</b>										
SR 267	C		C	C	C	C	F(2)	D	F(2)	C
Secline Street	F		F	F	F	F	F	F	F	F
Deer Street	D		E	E	E	E	F	F	F	F
Bear Street	F		F	B	A	B	F	F	B	F
Coon Street	B		A	B	A	B	D	F	D	F
Fox Street	F		F	F	F	F	F	F	F	F
Chipmunk Street	E		E	F	E	F	F	F	F	F
<b>SR 28 Winter Intersection LOS (1)</b>										
SR 267	D		D	C	D	C	F(2)	C	F(2)	C
Secline Street	F		F	F	F	F	F	F	F	E
Deer Street	C		C	D	C	D	F	F	F	F
Bear Street	F		F	B	A	B	F	F	B	F
Coon Street	A		A	B	A	B	D	F	D	F
Fox Street	F		F	E	F	E	F	F	F	F
Chipmunk Street	E		D	C	D	C	F	F	F	F
<b>Summer Roadway LOS</b>										
Peak Direction LOS	B		B	F	B	F	D	F	D	F
TRPA LOS Standard Exceeded?	EB	No	No	Yes	No	Yes	No	Yes	No	Yes
	WB	No	No	Yes	No	Yes	No	Yes	No	Yes
Days per Year TRPA LOS Standard Exceeded	EB	0	0	10	0	10	0	104	0	104
	WB	0	0	5	0	5	0	108	0	108
Days per Year With 1 or More Hour of LOS F	EB	0	0	10	0	10	0	104	0	104
	WB	0	0	5	0	5	0	108	0	108
Hours per Year of LOS F	EB	0	0	28	0	28	0	670	0	670
	WB	0	0	15	0	15	0	774	0	774
Maximum Hours per Day of LOS F	EB	0	0	7	0	7	0	11	0	11
	WB	0	0	6	0	6	0	11	0	11
<b>Winter Roadway LOS</b>										
Peak Direction LOS	B		B	F	B	E	E	F	E	F
TRPA LOS Standard Exceeded?	EB	No	No	Yes	No	No	No	Yes	No	Yes
	WB	No	No	Yes	No	No	No	Yes	No	Yes
Hours per Peak Day LOS F	EB	0	0	3	0	0	0	3	0	3
	WB	0	0	1	0	0	0	1	0	1
<b>Maximum Daily Traffic Volume on Residential Streets</b>	2000		2000	2000	2000	2000	2800	5400	2800	5400
<p>Note 1: Total intersection LOS for signalized intersection, worst approach LOS for roundabout and Stop sign controlled.</p> <p>Note 2: Unmitigated. With separate WB right-turn lane, LOS D is provided.</p>										

**TABLE 15: Existing Peak Winter Design Peak Hour Intersection LOS**

SR 28 @	Existing Traffic Control	Worst Approach		Total Intersection	
		Delay (s/veh)	LOS	Delay (s/veh)	LOS
SR 267	Signal	—	—	43.9	D
Secline Street (1)	Two-Way Stop Controlled	331.9	F	—	—
Deer Street	Two-Way Stop Controlled	23.5	C	—	—
Bear Street (1)	Two-Way Stop Controlled	77.0	F	—	—
Coon Street	Signal	—	—	9.7	A
Fox Street	Two-Way Stop Controlled	92.5	F	—	—
Chipmunk Street	Two-Way Stop Controlled	31.6	D	—	—

*Note 1: Although the none of the minor street southbound approaches are striped with separate right-turn lanes, the southbound approaches to the Secline and Bear intersections are wide and used as if there are separate right-turn lanes. Therefore, the LOS at these two intersections was calculated assuming separate right-turn lanes on the southbound approaches.*

## 2.6 Evaluation of Future 2008 Transportation Conditions – Alternative 1 – No Project

As is standard practice for environmental impact documentation, future traffic conditions are evaluated for the first year that the potential roadway modifications could be in place (2008), and for 20 years beyond this first year (2028). Traffic volumes for the 2008 analysis are estimated by factoring existing volumes by current trends in traffic volumes. No growth in north/south street traffic is assumed (as future land use growth within Kings Beach will be largely constrained by TRPA development controls). At the time of preparation of this report, decisions regarding parking lot locations are not finalized; therefore no adjustments have been made to reflect the traffic impacts associated with new parking facilities. However, the segment of Brook Avenue from Bear Street to Coon Street would need to be converted to one-way eastbound operation in order for either the signal or roundabout at the Bear/SR 28 intersection to operate; this modification is therefore assumed.

Traffic volumes for this analysis are estimated by factoring existing volumes by current trends in traffic volumes. As shown in Table 1, peak month average daily traffic volumes increased by an average of 31 percent per year on SR 28 east of Coon Street between 1992 and 2002, and increased by an average of 70 percent per year on SR 267 north of SR 28. These growth rates were applied to the existing directional link design volumes for the six years between the 2002 counts and the 2008 design year, which indicated that one-way traffic volumes on SR 28 east of SR 267 will increase by 20 vehicles per hour over this period, while one-way traffic volumes on SR 267 north of SR 28 will increase by 25 vehicles per hour. These increases were used to adjust traffic volumes through the study area, assuming none of this increase is “lost” at other study area intersections. In addition, the impacts of the conversion of Brook Street to one-way were used to adjust the intersection turning movement figures, based on existing turning movement patterns. Finally, traffic was shifted from southbound Coon Street to southbound Bear Street to reflect the improvement in access onto SR 28 associated with either a signal or roundabout at Bear Street.

The resulting 2008 summer design volumes are presented in Table 17, while 2008 winter design volumes are shown in Table 18. Comparing these figures with the existing design figures shown in Tables 7 and 8 indicates that total intersection volumes will increase from 1.5 percent to 4.1 percent between 2002 and 2008 (depending upon the specific intersection). Total two-way daily traffic volume on SR 28 just east of SR 267 is forecast to be 27,800 on the summer design day and 23,300 on the winter peak day, based upon the forecast methodology presented above. These traffic volume estimates do not reflect diversion

TABLE 16: Accident Evaluation for SR 28 in Kings Beach, 1996-2004														
SR 28 Intersection	Milepost	Total Accidents		Avg Annual	Fatalities	Injuries	Estimated MVM/MV	Accident Rate/MVM or /MV		Average California Statewide Rate per MVM (1)		% of Statewide Average		
		Number	Percent					Total	Injury	Total	Injury	Fatality	Total	Injury
<b>Location of Accident (1)</b>														
Junction 267	9.340	34	13.1%	3.8	0	8	71.2	MV	0.48	0.11	0.32	0.01	69%	35%
Secline Street	9.430	35	13.5%	3.9	0	8	62.1	MV	0.56	0.13	0.09	0.00	255%	137%
Midblock		11	4.2%	1.2	0	1	3.6	MVM	3.06	0.28	0.60	0.03	255%	47%
Deer Street	9.585	44	17.0%	4.9	0	11	59.6	MV	0.74	0.18	0.22	0.09	336%	197%
Midblock		4	1.5%	0.4	0	1	2.3	MVM	1.72	0.43	1.20	0.03	143%	72%
Bear Street and Brook Street	9.720	22	8.5%	2.4	0	3	61.4	MV	0.36	0.05	0.33	0.15	109%	33%
Midblock		7	2.7%	0.8	0	2	3.6	MVM	1.93	0.55	1.20	0.60	161%	92%
Coon Street	9.880	28	10.8%	3.1	0	11	60.8	MV	0.46	0.18	0.70	0.32	66%	57%
Midblock		7	2.7%	0.8	0	3	2.7	MVM	2.61	1.12	1.20	0.60	218%	187%
Fox Street	10.025	36	13.9%	4.0	1	13	54.5	MV	0.66	0.24	0.22	0.09	300%	255%
Midblock		6	2.3%	0.7	0	2	4.9	MVM	1.21	0.40	1.20	0.60	101%	68%
Chipmunk Street	10.215	11	4.2%	1.2	0	3	51.1	MV	0.22	0.06	0.22	0.09	100%	63%
Beaver Street	10.263	13	5.0%	1.4	0	3	50.8	MV	0.26	0.06	0.22	0.09	118%	63%
9-Year Total		259	100.0%	28.8	1	70								
<b>Year of Accident</b>														
1996 (Apr - Dec)	-	16	6.2%	-	0	1								
1997	-	23	8.9%	-	0	6								
1998	-	21	8.1%	-	0	6								
1999	-	38	14.7%	-	0	11								
2000	-	28	10.8%	-	0	7								
2001	-	33	12.7%	-	0	11								
2002	-	34	13.1%	-	1	12								
2003	-	35	13.5%	-	0	8								
2004	-	31	12.0%	-	0	8								
9-Year Total	-	259	100.0%	-	1	70								
<b>Type of Collision</b>														
Head-On	-	9	3.5%	1.0	0	4								
Sideswipe	-	40	15.4%	4.4	0	5								
Rear-End	-	78	30.1%	8.7	0	21								
Broadside	-	90	34.7%	10.0	0	18								
Hit Object	-	12	4.6%	1.3	0	2								
Auto/Pedestrian	-	14	5.4%	1.6	1	13								
Auto/Bicycle	-	8	3.1%	0.9	0	7								
Other	-	8	3.1%	0.9	0	0								
9-Year Total	-	259	100.0%	28.8	1	70								
MV = Million Vehicle movements through the intersection, MVM = Million Vehicle Miles along roadway segments. Note 1: Per Caltrans Headquarters Traffic Safety Investigations Branch standards, accidents within 250 feet of an intersection are assigned to the intersection. Roadway segments less than 500 feet in length are therefore not analyzed separately. Source: Caltrans District 3 TASAS Table B Accident Records, (April 1, 1996 through December 31, 2004), and "2003 Collision Data on California State Highways (Caltrans).														

**TABLE 17: Peak Hour Summer 2008 Intersection Turning Movement Design Volumes**

SR 28 @	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
267	343	1	269	3	675	442	1	0	3	202	834	1	2,774
Secline	39	2	17	22	1075	36	24	1	26	42	1126	11	2,421
Deer	3	0	24	25	1074	22	0	0	5	33	1126	14	2,326
Bear	45	4	72	40	1023	62	13	0	73	68	994	59	2,453
Coon	78	27	87	33	957	19	32	7	42	57	958	77	2,374
Fox	36	3	50	3	912	71	0	0	0	48	1005	0	2,128
Chipmunk	21	0	13	0	929	16	0	0	0	37	981	0	1,997

**TABLE 18: Peak Hour Winter 2008 Intersection Turning Movement Design Volumes**

SR 28 @	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
267	503	6	269	3	566	398	1	0	1	176	687	0	2,610
Secline	36	2	15	21	928	31	20	1	26	42	1136	11	2,269
Deer	3	0	21	24	924	19	0	0	5	33	1133	14	2,176
Bear	41	4	58	37	884	55	11	0	74	68	1000	60	2,292
Coon	73	27	78	30	823	14	27	7	43	58	959	78	2,217
Fox	33	3	42	3	778	60	0	0	0	48	1002	0	1,969
Chipmunk	19	0	11	0	786	14	0	0	0	37	975	0	1,842

of traffic that may occur from traffic delays at intersections or along roadway segments. In addition, these volumes do not reflect the trip generation that may result from the addition of any major new off street parking areas.

#### Intersection Level of Service – 2008: Alternative 1 – No Project

Tables 19 and 20 present the intersection LOS, assuming no change in existing configuration, for summer and winter conditions, respectively. As shown, the SR 28/SR 267 intersection would operate at LOS C in summer and LOS D in winter, while the SR 28/Coon Street intersection would operate at LOS A in both summer and winter conditions. Also for both summer and winter, the worst approach (side street) LOS on Secline Street, Bear Street, and Fox Street would be LOS F. The Deer Street intersection would provide LOS D worst approach conditions in the summer and LOS C in the winter, and the Chipmunk Street intersection would provide LOS E in the summer and LOS F in the winter on the worst approach.

**TABLE 19: 2008 Summer Peak Hour Intersection LOS –  
Alternative 1 – No Project**

SR 28 @	Traffic Control	No Project LOS			
		Worst Approach		Total Intersection	
		Delay (s/veh)	LOS	Delay (s/veh)	LOS
SR 267	Signal	—	—	29.0	C
Secline Street	Two-Way Stop Controlled	600.3	F	—	—
Deer Street	Two-Way Stop Controlled	28.6	D	—	—
Bear Street	Two-Way Stop Controlled	258.3	F	—	—
Coon Street	Signal	—	—	10.0	A
Fox Street	Two-Way Stop Controlled	122.1	F	—	—
Chipmunk Street	Two-Way Stop Controlled	41.7	E	—	—

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**TABLE 20: 2008 Winter Peak Hour Intersection LOS –  
Alternative 1 – No Project**

SR 28 @	Existing Traffic Control	No Project LOS			
		Worst Approach		Total Intersection	
		(s/veh)	LOS	(s/veh)	LOS
SR 267	Signal	—	—	37.8	D
Secline Street (1)	Two-Way Stop Controlled	384.1	F	—	—
Deer Street	Two-Way Stop Controlled	24.2	C	—	—
Bear Street	Two-Way Stop Controlled	335.1	F	—	—
Coon Street	Signal	—	—	9.6	A
Fox Street	Two-Way Stop Controlled	105.2	F	—	—
Chipmunk Street	Two-Way Stop Controlled	295.5	F	—	—

*Note 1: Although none of the minor street southbound approaches are striped with separate right-turn lanes, the southbound approach to the Secline intersection is wide and used as if there is a separate right-turn lanes. Therefore, the LOS at this intersection was calculated assuming a separate right-turn lane on the southbound approach.*

## Roadway Segment Level of Service – 2008: Alternative 1 – No Project

To analyze roadway LOS under the existing four-lane roadway configuration, the *Highway Capacity Manual* methodology for urban arterials was applied. Under this methodology, LOS is a measure of total travel speed through the corridor. For the design period in the peak direction, LOS B was found for summer 2008 conditions in the peak direction, with a travel speed of 28.3 miles per hour. LOS B conditions were also found for winter 2008 conditions, with a travel speed of 29.6 miles per hour.

## 2.7 Evaluation of 2028 Transportation Conditions: Alternative 1 – No Project

While optimally a valid and calibrated regional traffic computer model would be available as the source for long term traffic forecasts, one does not currently exist for the Tahoe Region. Consistent with Caltrans requirements, it is therefore necessary to conduct a detailed analysis of the potential “buildout” of the various land use plans, as well as other factors, that will result in additional traffic on Kings Beach streets. Table 21 presents a summary of the intersection turning movements generated by each source of traffic volume growth. These volumes were generated as follows:

- The TRPA has designated a series of Community Plan areas around the Tahoe Region. The land uses and associated traffic generation of the various North Shore Community Plan areas is shown in Table 22. As presented in the *North Tahoe Community Plans EIR/EIS* and the *Tahoe City Community Plan EIR/EIS*, this traffic was distributed to the various North Tahoe major roadways, which provided future buildout turning movements at the SR 28/SR 267 intersection. For instance, the top portion of Table 21 presents these turning movements for the buildout of the Community Plans between Tahoe Vista and Tahoe City. For the intersections east of SR 267, turning volumes on the side streets were estimated based upon the existing turning movement patterns in Kings Beach.
- The impacts of the Kings Beach Industrial Community Plan (which encompasses the area along Speckled Avenue) was distributed in a similar fashion. It was assumed that all of this traffic exits Speckled Avenue onto SR 267.
- The impacts of the Kings Beach Commercial Community Plan were identified based upon the trip generation shown in Table 22 and the distribution pattern presented in the *North Tahoe Community Plans EIR/EIS*. It was also necessary to allocate the traffic generation to the areas served by the various side streets along SR 28, which was done based upon the existing traffic patterns. The resulting individual intersection turning movements onto and off of SR 28 were then balanced to yield the total impacts on intersection turning movements.
- Traffic impacts associated with Community Plan buildout in Incline Village/Crystal Bay were estimated in a similar fashion to that used to estimate the impacts of the Community Plans to the west of Kings Beach.
- Residential development in the Tahoe Basin outside of the community plan areas was based upon the number of remaining dwelling unit allocations in each area and the distribution of traffic generated in each community presented in the community plan environmental documents. The number of additional dwelling units that could be constructed in each area is based upon information provided by Placer County Planning Department and TRPA.

**TABLE 21: 2002-2028 Growth in Traffic Volumes**

SR 28 @	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
<b><u>Impact of Tahoe Vista – Tahoe City Residential Development</u></b>													
267	0	0	12	*	0	35	0	0	0	11	34	0	92
Secline	0	0	0	0	35	0	0	0	0	0	34	0	69
Deer	0	0	1	0	34	0	0	0	0	1	33	0	69
Bear	0	0	1	0	33	0	0	0	0	1	32	0	67
Coon	0	0	1	0	31	0	1	0	0	0	31	1	65
Fox	0	0	1	0	30	0	0	0	0	1	30	0	62
Chipmunk	0	0	1	0	29	0	0	0	0	2	28	0	60
<b><u>Impact of Kings Beach Industrial Community Plan</u></b>													
267	5	0	4	0	0	5	0	0	0	4	0	0	18
Secline	0	0	0	0	5	0	0	0	0	0	5	0	10
Deer	0	0	0	0	5	0	0	0	0	0	5	0	10
Bear	0	0	0	0	5	0	0	0	0	0	5	0	10
Coon	0	0	1	0	4	0	0	0	0	0	4	1	10
Fox	0	0	1	0	3	0	0	0	0	1	3	0	8
Chipmunk	0	0	0	0	3	0	0	0	0	0	3	0	6
<b><u>Impact of Kings Beach Commercial Community Plan</u></b>													
267	14	0	11	0	5	18	0	0	0	1	34	0	83
Secline	6	0	5	0	34	6	0	0	0	5	34	0	90
Deer	4	0	3	0	37	4	0	0	0	3	37	0	88
Bear	8	0	9	0	32	8	9	0	0	9	32	0	107
Coon	12	0	14	0	27	12	0	0	0	14	27	0	106
Fox	7	0	10	0	30	7	0	0	0	10	30	0	94
Chipmunk	3	0	4	0	33	3	0	0	0	4	33	0	80
<b><u>Impact of Stateline to Incline Village Community Plans</u></b>													
267	26	0	0	*	0	56	28	0	0	0	54	0	164
Secline	1	0	0	0	84	1	0	0	0	0	80	0	166
Deer	1	0	0	1	85	0	0	0	0	0	81	0	167
Bear	0	0	0	1	86	1	0	0	2	0	82	0	171
Coon	2	0	0	1	87	1	0	0	0	0	82	0	174
Fox	2	0	0	0	90	2	0	0	0	0	84	0	177
Chipmunk	1	0	0	0	91	1	0	0	0	0	86	0	178
<b><u>Impact of Tahoe Vista – Tahoe City Residential Development</u></b>													
267	0	0	5	*	0	17	0	0	0	3	9	0	34
Secline	0	0	0	0	17	0	0	0	0	0	9	0	26
Deer	0	0	1	0	16	0	0	0	0	0	9	0	26
Bear	0	0	1	0	15	0	0	0	0	0	9	0	25
Coon	0	0	0	0	15	0	0	0	0	0	8	1	24
Fox	0	0	1	0	14	0	0	0	0	0	8	0	23
Chipmunk	0	0	0	0	14	0	0	0	0	0	8	0	22
<b><u>Impact of Kings Beach Residential Development</u></b>													
267	14	0	11	0	21	18	0	0	0	17	39	0	120
Secline	2	0	3	0	36	3	0	0	0	4	49	0	97
Deer	1	0	4	0	35	2	0	0	0	3	48	0	93
Bear	3	0	7	0	30	4	0	0	0	9	40	0	93
Coon	5	0	11	0	23	7	0	0	0	14	29	0	89
Fox	3	0	7	0	23	3	0	0	0	10	24	0	70
Chipmunk	0	0	4	0	22	1	0	0	0	4	23	0	54
<b><u>Impact of Incline Village Residential Development</u></b>													
267	37	0	0	0	40	20	0	0	0	0	74	0	171
Secline	1	0	0	0	60	1	0	0	0	0	111	0	173
Deer	1	0	0	0	61	0	0	0	0	0	112	0	174
Bear	0	0	0	0	61	1	0	0	2	0	113	0	178
Coon	2	0	0	0	63	2	0	0	1	0	113	0	181
Fox	2	0	0	0	64	1	0	0	0	0	115	0	183
Chipmunk	1	0	0	0	65	0	0	0	0	0	117	0	184
<b><u>Impact of Town of Truckee Development</u></b>													
267	150	0	122	0	0	262	0	0	0	124	0	0	658
Secline	0	0	0	0	262	0	0	0	0	0	122	0	384
Deer	0	0	8	0	254	0	0	0	0	3	118	1	384
Bear	0	0	8	0	245	0	1	0	0	2	114	2	372
Coon	0	0	7	0	235	0	3	0	0	2	109	3	359
Fox	0	0	7	0	228	0	0	0	0	3	106	0	344
Chipmunk	0	0	9	0	219	0	0	0	0	4	102	0	334
<b><u>Impact of Martis Valley Community Plan</u></b>													
267	95	0	77	0	0	152	0	0	0	72	0	0	396
Secline	0	0	0	0	152	0	0	0	0	0	72	0	224
Deer	0	0	5	0	147	0	0	0	0	1	70	1	224
Bear	0	0	4	0	142	0	1	0	0	2	67	1	217
Coon	0	0	4	0	136	0	2	0	0	1	65	1	209
Fox	0	0	4	0	132	0	0	0	0	2	63	0	201
Chipmunk	0	0	5	0	127	0	0	0	0	3	60	0	195
<b><u>Impact of Increase in Through Traffic Through All of North Tahoe / Truckee / Incline Village Region</u></b>													
267	21	0	0	0	0	20	0	0	0	0	0	0	40
Secline	0	0	0	0	20	0	0	0	0	0	21	0	40
Deer	0	0	0	0	20	0	0	0	0	0	21	0	40
Bear	0	0	0	0	20	0	0	0	0	0	21	0	40
Coon	0	0	0	0	20	0	0	0	0	0	21	0	40
Fox	0	0	0	0	20	0	0	0	0	0	21	0	40
Chipmunk	0	0	0	0	20	0	0	0	0	0	21	0	40

**TABLE 22: Traffic Generation of Future Land Uses in North Tahoe Region**

Area/Land Use	Size	Units	Trip Generation Rate			Total Trips				ADT	Trip Reductions		Newly-Generated Trips			
			Peak Hour		ADT	Peak Hour			Intercept		Pass-by	Peak Hour			ADT	
			In	Out		In	Out	Total				In	Out	Total		
<b><u>Carnelian Bay Community Plan</u></b>																
Commercial: New Allocation	2	KSF	2.5	2.5	40.7	5	5	10	80	40%	30%	2	2	4	24	
Beach Recreation	40	PAOT	0.06	0.06	0.57	2	2	4	20	60%	20%	0	0	0	4	
TOTAL						7	7	14	100			2	2	4	28	
<b><u>Tahoe Vista Community Plan</u></b>																
Commercial: New Allocation	7.5	KSF	2.5	2.5	40.7	19	19	38	310	40%	30%	6	6	12	93	
Housing Units	10	units	0.64	0.37	10.06	6	4	10	100	60%	20%	1	1	2	20	
TOTAL						25	23	48	410			7	7	14	113	
<b><u>Kings Beach Commercial Community Plan</u></b>																
Commercial (1)	80	KSF	2.5	2.5	40.7	200	200	400	3,260	40%	30%	60	60	120	978	
Beach Recreation	750	PAOT	0.06	0.06	0.57	45	45	90	430	40%	10%	23	23	46	215	
Public Pier	--	--	--	--	--	10	10	20	140	60%	20%	2	2	4	28	
TOTAL						255	255	510	3,830			85	85	170	1,221	
<b><u>Kings Beach Industrial Community Plan</u></b>																
Commercial: New Allocation	13	KSF	2.5	2.5	40.7	33	33	66	530	40%	30%	10	10	20	159	
Police Substation	--	--	--	--	--	0	5	10	50	100%	0%	0	0	0	0	
TOTAL						33	38	76	580			10	10	20	159	
<b><u>North Stateline Community Plan</u></b>																
Commercial	19.6	KSF	2.5	2.5	40.7	49	49	98	800	40%	30%	15	15	30	240	
Tourist Units: Transfer	45	units	0.40	0.32	8.00	18	14	32	360	10%	0%	16	13	29	324	
Housing Units	50	MFDU	0.38	0.28	6.10	19	14	33	310	20%	0%	15	11	26	248	
TOTAL						86	77	163	1,470			46	39	85	812	
<b><u>Incline Commercial Community Plan</u></b>																
Commercial: New	23	KSF	2.5	2.5	40.7	58	58	116	950	40%	30%	17	17	34	285	
Housing Units	92	MFDU	0.38	0.28	6.10	35	26	61	560	20%	0%	28	21	49	448	
TOTAL						93	84	177	1,510			45	38	83	733	
<b><u>Incline Tourist Community Plan</u></b>																
Commercial: New	12	KSF	2.5	2.5	40.7	30	30	60	480	40%	30%	9	9	18	144	
Housing Units	110	DU	0.64	0.37	10.06	70	41	111	1,110	20%	0%	56	33	89	888	
College Expansion	500	Students	0.07	0.16	2.37	33	82	115	1,190	0%	0%	33	82	115	1,190	
TOTAL						133	153	286	2,780			98	124	222	2,222	
<b><u>Ponderosa Ranch Community Plan</u></b>																
Commercial: New	17	KSF	2.5	2.5	40.7	41	41	82	670	40%	30%	12	12	24	201	
Housing Units	50	MFDU	0.38	0.28	6.10	19	14	33	310	20%	0%	15	11	26	248	
TOTAL						60	55	115	980			27	23	50	449	
<b><u>Tahoe City Community Plan</u></b>																
Commercial (1)	90	KSF	2.50	2.50	41	225	225	450	3,660	40%	30%	68	68	136	1,098	
Tourist Units	25	Units	0.50	0.40	10.0	13	10	23	250	10%	0%	12	9	21	225	
Housing Units	20	Units	0.64	0.37	10	13	7	20	200	20%	0%	10	6	16	160	
Marina	400	slips	0.10	0.10	3	40	40	80	1,200	0%	30%	28	28	56	840	
Summer Visitors	600	PAOT	0.05	0.05	2	30	30	60	1,200	40%	10%	15	15	30	600	
Transit Terminal						78	117	195	1,300	0%	92%	6	9	15	104	
TOTAL						399	429	828	7,810			139	135	274	3,027	
<b><u>West Shore Community Plan</u></b>																
Commercial (1)	30	KSF	2.50	2.50	41	75	75	150	1,220	40%	30%	23	23	46	366	
Tourist Units	95	Units	0.50	0.40	10.0	48	38	86	950	10%	0%	43	34	77	855	
Campground Users	900	POA	0.09	0.07	2	80	64	144	1,440	10%	0%	72	58	130	1,296	
Summer Day Visitors	600	PAOT	0.05	0.05	2	30	30	60	1,200	40%	10%	15	15	30	600	
TOTAL						233	207	440	4,810			153	130	283	3,117	
<b><u>Additional Housing Units</u></b>																
West Shore	258	DU	0.64	0.37	10.06	165	95	260	2,600	20%	0%	132	76	208	2,080	
Tahoe City Area	215	DU	0.64	0.37	10.06	138	80	218	2,160	20%	0%	110	64	174	1,728	
Tahoe Vista Area	172	DU	0.64	0.37	10.06	110	64	174	1,730	20%	0%	88	51	139	1,384	
Kings Beach Area	215	DU	0.64	0.37	10.06	138	80	218	2,160	20%	0%	110	64	174	1,728	
Incline Village	900	DU	0.64	0.37	10.06	576	333	909	9,050	20%	0%	461	266	727	7,240	

Note 1: Assuming that half of the 80,000 in bonus commercial floor area develops in the Tahoe City area, and half in the Kings Beach area.

SOURCE: "North Tahoe Community Plan EIR/EIS", TRPA, 1996, and "Revised Draft Environmental Impact Report/Statement: Tahoe City Community Plan" (1993), Sue Rae Irellan Environmental Planning.

- Traffic impacts associated with Town of Truckee development were identified from the Town's TMODEL traffic model, which provided traffic volume impacts on SR 267 at Brockway Summit, as shown in Table 23. These volumes were reduced by 5 percent to reflect traffic to/from areas along SR 267 between Brockway Summit and SR 28, and allocated to turning movements at SR 267/SR 28 based on existing turning movement patterns. Turning movements at the local side streets along SR 28 were estimated based upon current turning movement patterns.
- Traffic impacts associated with the Martis Valley Community Plan were estimated in a fashion identical to that presented above regarding the Town of Truckee General Plan impacts. These volumes reflect the revised version of the Preferred Alternative (a total of 8,600 dwelling units), factored to reflect the highest growth rate considered by the Placer County Planning Department to be feasible. Specifically, the Placer County Planning Director has developed a range of feasible growth scenarios for the Martis Valley land uses, which range up to a growth rate of 6 percent. At this highest growth rate, 6,665 dwelling units would be built out in 2028 (equal to 95.6 percent of the plan total). The traffic volumes identified in the *Draft Martis Valley Community Plan EIR* (PMC, 2003) were reduced by 11 vehicles per hour in the southbound direction and 8 vehicles per hour in the northbound direction to reflect this level of buildout in 2028.

Since adoption of the Martis Valley Community Plan, several individual projects in the Plan area have been approved with land use quantities less than those identified in the Plan. A review of these more recent land use plans indicates that the overall change in future potential growth in traffic volumes through Kings Beach is less than 2 percent. The overall impact on the findings of this traffic study would therefore not be materially changed by this reduction in land use.

- Finally, it is necessary to estimate the future growth in vehicles traveling completely through the other areas considered (North Tahoe, Martis Valley, and the Town of Truckee). To be considered a "through" trip, for example, a vehicle would need to travel from Donner Summit or beyond to Incline Village. While there is no data available regarding trip patterns, the proportion of traffic on SR 28 in Kings Beach that does not make any stops within this large study area would be no more than 5 percent. Using the counts conducted in the Summer of 2002, the 30th-highest peak hour counts were 1,160 eastbound and 1,100 westbound. Applying the 5 percent factor, through traffic in 2000 was no more than 112 eastbound and 103 westbound. Caltrans counts from 1991 through 2001 indicate the highest growth in peak month daily volumes on nearby roadways was 1.18 percent on SR 267 over Brockway Summit. Factoring the existing through estimates by this growth rates indicates that peak hour peak month through volumes will grow by 21 eastbound and 20 westbound by 2028.

Note that no growth in traffic volumes in Kings Beach was included to reflect additional development on the West Shore or in Alpine Meadows/Squaw Valley. Traffic to and from these areas during peak periods is currently constrained by the capacity of SR 28 in Tahoe City. As there are no plans adopted or under consideration that would increase the roadway capacity of SR 28, nor are any such improvements (such as an additional east-west roadway) reasonably feasible, there is little potential that growth in traffic generation west of Tahoe City would actually increase volumes in Kings Beach significantly. The traffic volumes associated with the various growth elements shown in Table 21 were added to the 2002 and 2003 design volumes shown in Tables 7 and 8. The resulting traffic volumes, unconstrained by limits on roadway capacity (other than the Tahoe City constraint discussed above), are presented in Table 24 for summer conditions.

TABLE 23: Impact of Truckee and Martis Valley Growth on Traffic Volumes in Kings Beach													
Assumptions:		Buildout of Town of Truckee General Plan Highest Potential Growth Rate (6 %) of the Martis Valley CP Revised Proposed Land Use Diagram (8,600 Dwelling Units)											
Area	Total Growth in PM Peak Hour Volumes at Brockway Summit (1)			% of Traffic To/From Land Uses Along SR 267		Volume Just N of SR 28		% of Traffic on SR 267 at Intersection with SR 28 Traveling to/from SR 28 to East (2)		SR 267/SR 28 Pk-Hr Turning Movement			
	NB	SB	Total	NB	SB	NB	SB	NB	SB	Southbound	Westbound	Eastbound	
										Left	Right	Left	Right
Town of Truckee - SR 267	406	286	692	5%	5%	386	272	68%	55%	150	122	262	124
Martis Valley - SR 267	236	181	417	5%	5%	224	172	68%	55%	95	77	152	72
Note 1: Based on Town of Truckee TMODEL for General Plan Buildout, and draft Martis Valley CP traffic analysis for preferred land use alternative.													
Note 2: Based upon existing traffic count data.													

**TABLE 24: Peak Hour Summer 2028 Intersection Turning Movement Volumes – Not Constrained by North Stateline Signal**

SR 28 @	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
267	685	1	506	3	849	944	1	0	3	434	1,078	1	4,506
Secline	50	2	25	22	1,759	47	24	1	26	51	1,643	11	3,660
Deer	10	0	46	26	1,748	28	0	0	5	44	1,640	16	3,562
Bear	54	4	83	41	1,691	85	24	0	77	99	1,480	62	3,699
Coon	102	27	144	34	1,586	32	38	7	43	80	1,424	84	3,602
Fox	50	3	81	3	1,526	84	0	0	0	75	1,469	0	3,290
Chipmunk	26	0	36	*	1,532	21	0	0	0	54	1,442	0	3,111

For purposes of this traffic analysis, however, it is assumed that the existing traffic metering effect associated with the North Stateline pedestrian-actuated signal continues to limit peak traffic flows along SR 28 in 2028. This signal is located between the Tahoe Biltmore Casino and the Crystal Bay Club, and is actuated by pedestrian push buttons on either side of the roadway. Observations conducted by LSC staff indicates that during periods of peak pedestrian activity, this signal currently operates on a 95 second cycle length, with 65 seconds of green time for SR 28 traffic, 26.5 seconds of red time, and 3.5 seconds of yellow time. However, with increases in delays and congestion in the future, it is reasonable to expect that the Nevada Department of Transportation would extend the roadway green time to increase capacity, up to a maximum cycle length of 2.5 minutes. Analyzing this timing plan using the Highway Capacity Software (with a saturated flow rate of 1,600 vehicles per hour), the roadway capacity provided by this signal was calculated to equal 1,380 vehicles per hour in each direction at the signal location.

The unconstrained traffic volumes shown in Table 24 indicate that the 2028 design volumes on SR 28 east of Chipmunk Street are equal to 1,468 and 1,554 vehicles per hour in the eastbound and westbound directions, respectively. However, available turning movement counts indicate that traffic volumes tend to drop slightly between this location and the north Stateline signal. Counts conducted for the *Cal Neva Resort Timeshare Development Traffic and Air Quality Study* (LSC, 2001), as well as counts conducted at SR 28/Beaver Street and SR 28/Speedboat Avenue by LSC staff in July, 2003 indicates that traffic volumes drop between Chipmunk Street and the north Stateline signal by approximately 40 vehicles per hour. Adjusting for these figures, the design volumes at the north Stateline signal in 2028 are 1,428 and 1,514 vehicles per hour, in the eastbound and westbound directions respectively. Comparing these figures with the capacity of 1,380 vehicles per hour, the north Stateline signal effectively would reduce traffic volumes on SR 28 in Kings Beach by 48 vehicles per hour eastbound and 134 vehicles per hour westbound.

These figures represent vehicles either queuing to pass through the north Stateline signal (forming a long stop-and-go queue westbound on SR 28 east of the signal), or drivers who choose to travel at another time to avoid the roadway congestion. Experience at other Tahoe locations with recurring queuing (such as SR 89 at Fanny Bridge) indicates that traffic volumes at locations both before and after the constraint are reduced, as drivers learn to plan their trip times to avoid traffic delays. Comparing the unconstrained traffic forecasts with these constraint volumes, the extent of the eastbound traffic queues formed by the north Stateline signal in Kings Beach in 2028 can be calculated, assuming that the capacity of SR 28 in Kings Beach would be sufficient to deliver the volume to north Stateline. Traffic queues would form back into the eastern part of Kings Beach on a total of 31 days. On 8 of these days, queues would form back as far west as SR 267. The maximum total length of eastbound queue (excluding the Fourth of July period) would be roughly 4.1 miles.

Adjusting for this capacity constraint, Table 25 presents the 2028 summer peak hour design volumes. In the westbound direction, these volumes represent the level of traffic that can be delivered to Kings Beach given the capacity constraint at north Stateline, while in the eastbound direction they represent the volume that would be able to pass through each intersection given the presence of eastbound queues formed by the north Stateline signal. Comparing these figures with the 2002 design volumes shown in Table 7, 2028 volumes are estimated to exceed existing volumes by approximately 48 percent in the eastbound direction and 51 percent in the westbound direction. Total two-way daily traffic volume on SR 28 just east of SR 267 on the design day is forecast to be 42,900 vehicles per day, based upon the forecast methodology presented above.

**TABLE 25: Peak Hour Summer 2028 Intersection Turning Movement Design Volumes**

*Constrained by Capacity of North Stateline Pedestrian Signal*

SR 28 @	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
267	666	1	506	3	786	874	1	0	3	434	1,049	1	4,324
Secline	50	2	25	22	1,626	47	24	1	26	51	1,595	11	3,479
Deer	10	0	46	26	1,614	28	0	0	5	44	1,592	16	3,381
Bear	54	4	83	41	1,557	85	24	0	77	99	1,433	62	3,518
Coon	102	27	144	34	1,453	32	38	7	43	80	1,377	84	3,421
Fox	50	3	81	3	1,392	84	0	0	0	75	1,422	0	3,109
Chipmunk	26	0	36	0	1,399	21	0	0	0	54	1,394	0	2,930

Winter volumes in 2028 were developed as follows:

- The existing proportion of directional winter versus summer traffic volumes was determined.
- Future growth in summer traffic volumes on the state highways associated with the buildout of all North Tahoe/Martis Valley/Truckee land uses as well as associated with growth in through traffic (as discussed above), were factored by the winter/summer factor. This assumption infers that the ratio of summer to winter traffic levels will remain constant in the future. (It bears noting that no significant increase in traffic associated with growth of the Northstar-At-Tahoe Ski Area is expected, as the number of day skier parking spaces is not planned to increase.)
- Future growth in winter traffic on the Kings Beach local streets was assumed to be identical to the growth in summer volumes.
- Future growth in winter volumes was added to existing winter traffic volumes to identify 2028 winter traffic volumes. In addition, the traffic volume impacts were adjusted to reflect the conversion of Brook Avenue between Bear Street and Coon Street, as well as the traffic metering effect of the north Stateline pedestrian-activated signal.

The resulting growth in intersection turning movement traffic volumes from 2003 to 2028, added to the 2003 peak winter traffic volumes presented in Table 8 yields the forecast 2028 intersection turning movement volumes shown in Table 26. Winter peak day total volumes are forecast to be 36,000 vehicles per day.

#### Intersection Level of Service – 2028 Alternative 1- No Project

Table 27 presents the summer 2028 intersection LOS, assuming no change in existing roadway configuration, while Table 28 presents the winter 2028 intersection LOS. As shown, LOS F would be provided at the SR 267/SR 28 intersection and LOS C at the SR 28/Coon Street intersection. To provide adequate LOS at the SR 267/SR 28 intersection, a separate westbound right-turn lane would be required. All side street approaches to SR 28 would provide LOS F conditions. Winter LOS would be equal to or better than summer conditions.

#### Roadway Segment Level of Service – 2028: Alternative 1 – No Project

To analyze roadway LOS under the existing roadway configuration, the *Highway Capacity Manual* methodology for urban arterials was applied. Under this methodology, LOS is a measure of total travel speed through the corridor. For the design period in the peak direction, LOS E was found for 2028 summer conditions in the peak direction, with a travel speed of 16.3 miles per hour. For winter conditions, LOS E was found for 2028 conditions in the peak direction, with a travel speed of 13.8 miles per hour.

#### Consistency with Traffic Signal Warrants: Alternative 1 – No Project

A signal warrant analysis was conducted for the study area intersections for existing summer PM peak hour design volumes, forecasted 2008 PM peak hour design volumes, and forecasted 2028 peak hour design volumes. As Caltrans has jurisdiction along SR 28, the signal warrant analysis is based upon Caltrans standards. While there are no adopted warrants for installation of a roundabout, the signal warrants are assumed to be pertinent guidance regarding the placement of a roundabout, since both signals and roundabouts are intended as traffic control devices.

**TABLE 26: Peak Hour Winter 2028 Intersection Turning Movement Design Volumes**

*Constrained by Capacity of North Stateline Pedestrian Signal*

SR 28 @	Southbound			Westbound			Northbound			Eastbound			TOTAL
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
267	832	6	509	3	740	903	1	0	1	403	909	0	4,308
Secline	47	2	23	21	1,615	42	20	1	26	51	1,614	11	3,473
Deer	10	0	43	25	1,601	25	0	0	5	44	1,608	16	3,377
Bear	16	0	69	38	1,545	73	22	0	78	95	1,452	63	3,450
Coon	131	27	139	31	1,450	32	33	7	44	86	1,387	85	3,452
Fox	47	3	73	3	1,395	73	0	0	0	75	1,427	0	3,095
Chipmunk	24	0	35	0	1,391	19	0	0	0	54	1,396	0	2,920

**TABLE 27: 2028 Summer Peak Hour Intersection LOS –  
Alternative 1 No Project**

		No Project LOS			
		Worst Approach		Total Intersection	
SR 28 @	Existing Traffic Control	Delay (s/veh)	LOS	Delay (s/veh)	LOS
SR 267	Signal	—	—	154.9	F
Secline Street	Two-Way Stop Controlled	(1)	F	—	—
Deer Street	Two-Way Stop Controlled	546.6	F	—	—
Bear Street	Two-Way Stop Controlled	(1)	F	—	—
Coon Street	Signal	—	—	38.5	D
Fox Street	Two-Way Stop Controlled	(1)	F	—	—
Chipmunk Street	Two-Way Stop Controlled	299.9	F	—	—
<b>Required Intersection Configuration (Mitigated)</b>					
SR 267	Signal	—	—	57.0	E
Requires Separate Westbound Right-Turn Lane					
Note 1: Delay level too high to calculate					

**TABLE 28: 2028 Winter Peak Hour Intersection LOS – Alternative 1**

		No Project LOS			
		Worst Approach		Total Intersection	
SR 28 @	Traffic Control	Delay (s/veh)	LOS	Delay (s/veh)	LOS
SR 267	Signal	—	—	188.6	F
Secline Street (1)	Two-Way Stop Controlled	(1)	F	—	—
Deer Street	Two-Way Stop Controlled	(1)	F	—	—
Bear Street	Two-Way Stop Controlled	(1)	F	—	—
Coon Street	Signal	—	—	41.3	D
Fox Street	Two-Way Stop Controlled	(1)	F	—	—
Chipmunk Street	Two-Way Stop Controlled	59.4	F	—	—
<b>Required Intersection Configuration (Mitigated)</b>					
SR 267	Signal	—	—	74.2	E
Requires Separate Westbound Right-Turn Lane					
Note 1: Delay level too high to calculate					

The *California Manual of Uniform Traffic Control Devices* (MUTCD) (September 26, 2006) is the current adopted document used by Caltrans to determine whether a signal is warranted. Caltrans' Traffic Manual (November 1966) incorporates the MUTCD warrants as important elements in the decision to locate a new traffic signal as follows:

*“The justification for the installation of a traffic signal at an intersection is based on the warrants stated in this Manual and in the Manual on Uniform Traffic Control Devices published by the Federal Highways Administration. The decision to install a signal should not be based solely upon the warrants, since the installation of traffic signals may increase certain types of collisions. Delay, congestion, approach conditions, driver confusion, future land use or other evidence of the need for right of way assignment beyond that which could be provided by stop signs must be demonstrated”* (page 9-1).

Eight warrants for traffic signals are cited in Section 4 of the California MUTCD. The specific values used in these warrants depend upon the characteristics of the study site. Site conditions for the SR 28 intersections are assumed as follows:

- The 85th-percentile speed along SR 28 was assumed to be approximately 30-miles per hour.
- With the exception of the SR 267/SR 28 intersection, none of the minor street approaches are striped with separated left, through, or right-turn lanes. However, the southbound approaches of Secline Street and Bear Street SR 28 approaches are relatively wide and are observed to be used as if there are separate right-turn lanes. Therefore, it was assumed that these approaches do have separate right-turn lanes in the LOS analysis, but were considered one-lane approaches for the warrant analysis.
- Warrants 1, 2, and 3 are all dependent on the highest volume minor street approach and the total through volume on the major street. As allowed in the September 2006 revisions to the California MUTCD, the left-turn movements from the state highway are included in the highest volume minor street approach figure, and subtracted from the major street through volume.
- To account for the effect of pedestrian crossing demand in the warrant analyses, the number of bicycles and pedestrians that cross the highway at each is also added into the highest volume minor street approach volume.
- The study area is also considered to be in “an isolated community having a population of less than 10,000”, which allows for warrant threshold volumes that are 70 percent of the normal values in Warrants 1, 2, and 3.
- While signal warrant analyses are generally based upon “typical” traffic levels, rather than the relatively high design volumes used in other portions of this analysis, Caltrans has indicated that a 30th-highest peak hour level of traffic activity is appropriate for this specific analysis, in light of the relatively high accident rate and level of pedestrian activity in the corridor. The design hour volumes for the state highways shown in Table 7 were therefore used as the basis for this warrant analysis.
- It is also necessary to estimate 4th-highest and 8th-highest volumes for some of the warrants. Estimates of the 4th-highest and 8th-highest peak hour volumes based upon available hourly count data. To do this, hourly count data between June 2, 2002 and September 30, 2002 along SR 28 just east of SR 267 was reviewed. On busy days, the 4th-highest peak hour volume was approximately 87 percent of the peak hour volume and the 8th-highest peak hour volume was approximately 70 percent

of the peak hour volume along SR 28. Therefore, it was assumed, for example, that the 4th-highest peak hour volume per day on the SR 28 approaches were 80 percent of the design peak hour volume shown in Table 7. However, in 2028 traffic volumes on SR 28 will be more consistent over a longer period of the day, due to capacity constraints. For the SR 28 through volumes, analysis of the hour-by-hour data for the average Saturday in August indicates that the 4th-highest peak hour volume will be equal to the peak hour, while the 8th-highest peak hour volume will be 95 percent of the peak hour.

- As eight hours of count data is available at the Secline Street, Deer Street, Bear Street, and Fox Street intersections, the 4th-highest and 8th-highest peak hour approach volumes on the minor street approaches were estimated by multiplying the ratio of the 4th- and 8th-highest volumes to peak hour volumes as determined from the raw traffic count data by the design volumes. The four hour and eight hour turning-movement volumes at the Coon Street, and Chipmunk Street intersections were estimated assuming that the traffic variation along these side streets is equal to the average side street volume variation of the intersections for which there is data (Secline, Deer, Bear, and Fox). The variation of traffic on SR 267 was assumed to equal the variation of traffic on SR 28. The 2002 four hour and eight hour volume data is presented in Table 29.
- Accident data is available from 1997 through 2004 at each intersection, as shown in Table 16.
- Pedestrian count data is available for the following locations and time periods:
  - SR 267/SR 28, January 4, 2003, 8:00 AM to 5:50 PM
  - SR 28/Secline Street, July 31, 1999, 9:00 AM to 5:00 PM
  - SR 28/Deer Street, August 21, 1999, 8:15 AM to 4:15 PM
  - SR 28/Bear Street, July 10, 1999, 8:00 AM to 4:00 PM
  - SR 28/Fox Street, August 21, 1999, 8:00 AM to 4:00 PM

However, no pedestrian count data is available at Coon Street or Chipmunk Street. Informal observation by LSC staff indicates the pedestrian crossing activity is relatively high at Coon Street (at least equal to Bear Street) but relatively low at Chipmunk Street.

Note that this warrant analysis focuses on summer conditions only; as peak winter conditions are relatively infrequent, it is common to not base traffic signal warrants in the Tahoe Region solely on winter conditions. Based upon these assumptions and the additional data presented in Table 29, the results of the signal warrant analysis for the existing conditions are summarized in Table 30, as follows.

**Warrant 1 – Eight Hour Vehicular Volume:** *Based upon the estimated eight hour traffic volumes, this warrant is met for all study intersections.*

**Warrant 2 – Four Hour Vehicular Volume:** *This warrant is met at all study intersections.*

**Warrant 3 – Peak Hour:** *This warrant is met at all study intersections.*

**Warrant 4 – Pedestrian Volume:** *Although data regarding the number of gaps in traffic present on SR 28 is not available, this warrant is probably met at the SR 28/Bear Street and SR 28/Coon Street intersections based upon available pedestrian count data.*

**Warrant 5 – School Crossing:** *As there are no established school crossings along SR 28 in Kings Beach, this warrant is not potentially applicable to any of the SR 28 study intersections.*

**Table 29: Additional Data Used in Existing SR 28 Signal Warrant Analysis**

SR 28 @	Peak Hour		Estimated 4-Hr Volume		Estimated 8-Hr Volume		Number of Accidents in 9-Year Period (1996 through 2004)	Average Number of Accidents per Year (1997 through 2004)
	Major Street Approach Volume - Total of Both Directions (vph)	Volume on higher-volume approach (vph)	Major Street Approach Volume - Total of Both Directions (vph)	Minor Street Approach	Major Street Approach Volume - Total of Both Directions (vph)	Minor Street Approach		
267	1,948	536	1,695	482	1,364	429	34	3.8
Secline	2,071	53	1,802	41	1,450	23	35	3.9
Deer	2,055	25	1,788	15	1,439	4	44	4.9
Bear	1,974	92	1,717	57	1,382	30	22	2.4
Coon	1,857	194	1,616	118	1,300	60	28	3.1
Fox	1,823	82	1,586	35	1,276	23	36	4.0
Chipmunk	1,754	31	1,526	19	1,228	10	11	1.2

Source: LSC Transportation Consultants, Inc.

Table 30: Existing Conditions Signal Warrant Analysis												
SR 28 @	Warrant 1			Warrant 2	Warrant 3		Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8	Number of Warrants Met
	Condition A - Minimum Vehicle Volume	Condition B - Interruption of Continuous Traffic	Combination	4 Hour Volumes	Part A - Peak Hour Delay	Part B - Peak Hour Volume	Minimum Pedestrian Volume	School Crossings	Coordinated Signal System	Crash Warrant	Roadway Network	
SR 267	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	Yes	4
Secline Street	No	No	No	No	No	No	No	No	Not Applicable	No	No	0
Deer Street	No	No	No	No	No	No	No	No	Not Applicable	No	No	0
Bear Street	No	No	No	No	No	No	Yes	No	Not Applicable	No	No	1
Coon	No	No	No	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	3
Fox Street	No	No	No	No	No	No	No	No	Not Applicable	No	No	0
Chipmunk Street	No	No	No	No	No	No	No	No	Not Applicable	No	No	0
Source: LSC Transportation Consultants, Inc.												

**Warrant 6 – Coordinated Signal System:** *This warrant is not applicable to SR 28 in Kings Beach.*

**Warrant 7 – Crash Warrant:** *SR 28/Deer Street was the only intersection along SR 28 that reported an average accident rate per year approaching the warrant value, though the ability to remedy these accidents cannot be determined. Regardless, the intersection does not meet the corresponding volume requirements. Therefore, this warrant is not met at any of the SR 28 study intersections.*

**Warrant 8 – Roadway Network:** *This warrant is met at the SR 28/SR 267 intersection only.*

In total, three warrants are met at the Secline, Deer, Fox and Chipmunk Street intersections, while four warrants are met at the SR 267, Bear, and Coon intersections. It should be noted that satisfaction of one or more warrant does not necessarily indicate that a signal should or must be provided. As stated in Section 4C.01 of the California MUTCD, “*The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.*”

#### Signal Warrant Analysis – 2008 Conditions: Alternative 1 – No Project

The 2008 signal warrant analysis was based upon the 2008 30th-highest peak hour volumes. Through volumes on SR 28 were increased by the highest annual average growth rate observed at any one point along SR 28 in the study area between 1991 and 2001 (31 percent per year, observed east of Coon Street). No growth in side street volumes was assumed.

Additional volume data used in the analysis may be found in Table 31, while the results of the analysis are shown in Table 32. As Table 32 indicates, the same signal warrants are met under the 2008 conditions as are met under the existing conditions, largely because the 2008 design volumes are relatively similar to existing volumes. The signal warrant analysis therefore indicates that three to four warrants are met for a signal or roundabout at all study intersections.

#### Signal Warrant Analysis – 2028 Conditions: Alternative 1- No Project

The 2028 signal warrant analysis results are shown in Table 33. For 2028 conditions, the following intersections are found to meet signal warrants.

- **SR 28/SR 267:** Eight Hour Vehicular Volume Warrant, Four Hour Vehicular Volume Warrant, Peak Hour Warrant, and Roadway Network Warrant.
- **SR 28/Secline Street, SR 28/Deer Street, SR 28/Fox Street, SR 28/Chipmunk Street:** Eight Hour Vehicular Volume Warrant, Four Hour Vehicular Volume Warrant, and Peak Hour Warrant.
- **SR 28/Bear Street, SR 28/Coon Street:** Peak Hour Warrant, Four Hour Vehicular Volume Warrant, Peak Hour Warrant and Minimum Pedestrian Volume Warrant.

**Table 31: Additional Data Used in 2008 and 2028 SR 28 Signal Warrant Analysis**

SR 28 @	Peak Hour		Estimated 4-Hr Volume		Estimated 8-Hr Volume	
	Major Street Approach Volume - Total of Both Directions (vph)	Volume on higher-volume approach (vph)	Major Street Approach Volume - Total of Both Directions (vph)	Minor Street Approach	Major Street Approach Volume - Total of Both Directions (vph)	Minor Street Approach
<b>2008 Volume Data</b>						
267	1,966	559	1,710	503	1,376	447
Secline	2,107	53	1,833	41	1,475	23
Deer	2,091	25	1,819	15	1,464	4
Bear	2,052	79	1,785	49	1,436	26
Coon	1,880	224	1,636	137	1,316	69
Fox	1,859	82	1,617	35	1,301	23
Chipmunk	1,790	31	1,557	19	1,253	10
Source: LSC Transportation Consultants, Inc.						

<b>Table 32: 2008 Conditions Signal Warrant Analysis – All Alternatives</b>											
SR 28 @	Warrant 1		Warrant 2	Warrant 3		Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8	Number of Warrants Met
	Condition A - Minimum Vehicle Volume	Condition B - Interruption of Continuous Traffic	Four Hour Volumes	Part A - Peak Hour Delay	Part B - Peak Hour Volume	Minimum Pedestrian Volume	School Crossings	Coordinated Signal System	Crash Warrant	Roadway Network	
SR 267	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	Yes	4
Secline Street	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	No	3
Deer Street	Yes	Yes	Yes	No	Yes	No	No	Not Applicable	No	No	3
Bear Street	Yes	Yes	Yes	No	Yes	Yes	No	Not Applicable	No	No	4
Coon	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	4
Fox Street	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	No	3
Chipmunk Street	No	Yes	Yes	No	Yes	No	No	Not Applicable	No	No	3
Source: LSC Transportation Consultants, Inc.											KB Signal Warrant.wb3

<b>Table 33: 2008 Conditions Signal Warrant Analysis – All Alternatives</b>											
SR 28 @	Warrant 1		Warrant 2	Warrant 3		Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8	Number of Warrants Met
	Condition A - Minimum Vehicle Volume	Condition B - Interruption of Continuous Traffic	Four Hour Volumes	Part A - Peak Hour Delay	Part B - Peak Hour Volume	Minimum Pedestrian Volume	School Crossings	Coordinated Signal System	Crash Warrant	Roadway Network	
SR 267	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	Yes	4
Secline Street	Yes	Yes	Yes	No	Yes	No	No	Not Applicable	No	No	3
Deer Street	Yes	Yes	Yes	No	Yes	No	No	Not Applicable	No	No	3
Bear Street	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	4
Coon	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	4
Fox Street	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	No	3
Chipmunk Street	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	No	3
Source: LSC Transportation Consultants, Inc.											KB Signal Warrant.wb3

## Section 3

# Environmental Consequences/Impacts

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### 3.1 Impacts of Alternative 2

Alternative 2 is proposed to consist of a three-lane cross-section along SR 267, with roundabouts at Bear Street and at Coon Street. Brook Avenue would be converted to one-way eastbound from Bear Street to Coon Street. While on-street parallel parking would be provided along both sides of SR 28, parking would be prohibited during the summer season.

#### Post-Project Intersection Level of Service - 2008

Level of service at signalized and Stop sign controlled intersections were evaluated using the Highway Capacity Software package. Per Caltrans requirements, SIDRA (Version 3.1) was used to evaluate roundabout LOS. Table 34 presents the intersection LOS results for 2008 summer conditions. These conditions include the following:

- The Stop sign controlled intersections along SR 28 at Secline, Deer, and Fox Streets would provide poor (LOS E or F) conditions for side street approaches to the state highway in 2008, while the Chipmunk Street worst approach LOS would be C.
- At the Bear Street roundabout, a single-lane roundabout with the geometry identified in the alternative plans would provide total intersection LOS E conditions in 2008, with a worst-case approach (SR 28 eastbound and westbound) LOS of E.
- At the Coon Street roundabout, a single-lane roundabout would provide total intersection LOS E conditions in 2008. The worst-case Coon Street eastbound approach would experience LOS F in 2008. This LOS F condition would occur for roughly 40 hours per summer.
- At the SR 267/SR 28 signalized intersection, LOS C would be provided.

The LOS analyses for the roundabouts also indicate that long traffic queues would be formed along SR 28. The 95th-percentile queue length (that length which would be met or exceeded 5 percent of the time during the design hour) at the Bear Street roundabout would be 2,390 feet in the westbound direction and 2,277 in the eastbound direction, extending back through other public street intersections. At Coon Street, the 95th-percentile queue length would be 1,374 feet and 2,193 feet in the westbound and eastbound directions, respectively.

Winter LOS analysis results indicate a worst-approach LOS of E at the Bear Street roundabout and LOS F at the Coon Street location, with overall LOS of D at both locations. Very long queues would also form in this season, particularly at the Coon Street roundabout. The unsignalized intersections provide worst-approach LOS of E or F, with the exception of Chipmunk Street (LOS C).

#### Post-Project Intersection Level of Service – 2028

Table 35 presents the intersection LOS results for 2028 conditions. These conditions include the following:

- The Stop sign controlled intersections along SR 28 (Secline, Deer, Fox and Chipmunk Streets) would provide poor (LOS F) conditions for side street approaches to the state highway in 2028.

**TABLE 34: 2008 Peak Hour Intersection LOS – Alternative 2**

SR 28 @	Traffic Control	No Project LOS			
		Worst Approach		Total Intersection	
		(s/veh)	LOS	(s/veh)	LOS
<b>SUMMER</b>					
SR 267	Signal	—	—	29.0	C
Secline Street	Two-Way Stop Controlled	158.8	F	—	—
Deer Street	Two-Way Stop Controlled	47.5	E	—	—
Bear Street	Single-Lane Roundabout	74.3	E	68.8	E
Coon Street	Single-Lane Roundabout	91.0	F	56.8	E
Fox Street	Two-Way Stop Controlled	52.2	F	—	—
Chipmunk Street	Two-Way Stop Controlled	20.2	C	—	—
<b>WINTER</b>					
SR 267	Signal	—	—	37.8	D
Secline Street	Two-Way Stop Controlled	114.6	F	—	—
Deer Street	Two-Way Stop Controlled	48.5	E	—	—
Bear Street	Single-Lane Roundabout	76.1	E	43.9	D
Coon Street	Single-Lane Roundabout	87.6	F	48.3	D
Fox Street	Two-Way Stop Controlled	45.4	E	—	—
Chipmunk Street	Two-Way Stop Controlled	22.2	C	—	—
<i>Note 1: Delay level too high to calculate</i>					

**TABLE 35: 2028 Peak Hour Intersection LOS – Alternative 2**

SR 28 @	Traffic Control	Worst Approach		Total Intersection	
		Delay (s/veh)	LOS	Delay (s/veh)	LOS
<b>SUMMER</b>					
SR 267	Signal	—	—	154.9	F
Secline Street	Two-Way Stop Controlled	(1)	F	—	—
Deer Street	Two-Way Stop Controlled	(1)	F	—	—
Bear Street	Single-Lane Roundabout	333.4	F	290.9	F
Coon Street	Single-Lane Roundabout	317.5	F	262.7	F
Fox Street	Two-Way Stop Controlled	554.1	F	—	—
Chipmunk Street	Two-Way Stop Controlled	65.8	F	—	—
<b>Required Intersection Configuration (Mitigated)</b>					
SR 267	Signal	—	—	57.0	E
Requires Separate Westbound Right-Turn Lane					
<b>WINTER</b>					
SR 267	Signal	—	—	188.6	F
Secline Street	Two-Way Stop Controlled	359.3	F	—	—
Deer Street	Two-Way Stop Controlled	(1)	F	—	—
Bear Street	Single-Lane Roundabout	319.6	F	277.6	F
Coon Street	Single-Lane Roundabout	317.5	F	262.7	F
Fox Street	Two-Way Stop Controlled	(1)	F	—	—
Chipmunk Street	Two-Way Stop Controlled	66.2	F	—	—
<b>Required Intersection Configuration (Mitigated)</b>					
SR 267	Signal	—	—	74.2	E
Requires Separate Westbound Right-Turn Lane					
Note 1: Delay level too high to calculate					

- At both the Bear Street and Coon Street roundabouts, a single-lane roundabout of the size indicated in the alternative plans would provide worst-approach and total intersection LOS F conditions in 2028. The 95th-percentile queue lengths would be very long (calculated to exceed one mile).
- At the SR 267/SR 28 intersection, the existing configuration would operate at LOS F, with an average delay of 155 seconds. Providing a separate westbound right-turn lane would improve LOS of E, with 57 seconds of average delay.

Winter LOS analysis results are very similar, with LOS conditions occurring at the roundabouts, on the side street approaches to the Stop-sign-controlled intersections, and at the SR 267/SR 28 intersection with the existing configuration. As with the summer analysis, providing a separate westbound right turn lane at the SR 28/SR 267 intersection would improve LOS to E.

### Post-Project Roadway Level of Service

#### *SR 28 Roadway Capacity*

There is no standard traffic engineering analysis technique regarding the capacity associated with urban three-lane roadways operating under congested conditions with heavy parking, pedestrian and bicycle activity. It is therefore necessary to “calibrate” the capacity of a three-lane cross-section in Kings Beach against the observed capacity of a similar cross-section in Tahoe City. LSC staff conducted manual traffic counts on SR 28 in Tahoe City in the summer of 2002, taken just east of the State Recreation Area on the east side of town, as follows:

<u>Observed Capacity (Vehicles per Hour)</u>	<u>EB</u>	<u>WB</u>
Friday, July 12, 2002 - Starting 2:15 PM	822	698
Friday, August 9, 2002 - Starting 12:45 PM	709	741

Both counts were conducted when there was a stop-and-go queue formed by traffic entering Tahoe City from the east. While capacity varies with the level of pedestrian, bicycling, and parking activity, for typical levels of activity on SR 28 in Tahoe City, this data indicates a westbound capacity entering Tahoe City of 730 and an eastbound capacity exiting Tahoe City of 750.

These figures are far below (less than half) of the theoretical capacity of a two-lane roadway. The traffic engineering profession has not developed standard methods for assessing capacity along a congested recreational roadway such as SR 28 in Tahoe City or Kings Beach. It is therefore necessary to assess the impact of a variety of observed factors in Tahoe City that reduce capacity and then to adjust these figures to reflect the differing level of various factor impacting traffic capacity along SR 28 in Kings Beach versus Tahoe City. These factors are discussed below and presented in Table 36.

- **Driver characteristics** impact traffic flow. Recreational drivers tend to drive more erratically than commuters (for instance) and are more distracted by sights along the way. As a result, a “base” figure of 1,500 vehicles per hour per lane is appropriate (rather than the maximum value of 1,900 observed in other settings).
- **Pedestrians crossing the highway** require a portion of the time otherwise available for traffic movement. Counts conducted during busy summer conditions in Tahoe City indicate that 16.2 percent of total potential roadway capacity is eliminated due to this factor.

TABLE 36: Summer Capacity Analysis of Three-Lane SR 28 in Kings Beach With No On-Street Parking												
	Observed Conditions: Tahoe City WB	Forecast Conditions: Kings Beach										
		Deer - Bear EB	Bear - Coon EB	Coon - Fox EB	Chipmunk EB	Fox - Chipmunk	Chipmunk - Fox WB	Coon - WB	Fox - Coon	Bear - WB	Coon - WB	Deer - WB
		1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
<b>Ideal Capacity (At 25 mph)</b>												
<b>Reductions in Capacity</b>												
<u>Pedestrian Crossing</u>												
# Pedestrian Crossings/Hour	167	58	144	48	24	24	24	100	144	62	19	19
Pedestrians per Group	2	2	2	2	2	2	2	2	2	2	2	2
# Pedestrian Groups per Hour	83	29	72	24	12	12	12	50	72	31	10	10
Time Lost per Crossing (sec)	7	5	5	7	5	5	5	5	5	7	5	5
Total Time Lost per Hour (sec)	583	145	360	168	60	60	60	250	360	217	47.5	47.5
% Time Lost per Hour	16.2%	4.0%	10.0%	4.7%	1.7%	1.7%	1.7%	6.9%	10.0%	6.0%	1.3%	1.3%
<u>Bicycle Crossing</u>												
# Bicycle Crossings/Hour	25	2	2	4	1	1	1	2	2	0	1	1
Time Lost per Crossing (sec)	4	2	2	2	2	2	2	2	2	2	2	2
Total Time Lost per Hour (sec)	100	4	4	8	2	2	2	4	4	0	2	2
% Time Lost per Hour	2.8%	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.1%
<u>Bicycle Side Friction</u>												
# Bicycles per Hour	35	5	5	5	5	5	20	20	20	20	20	20
% Time Lost per Hour	3.0%	0.4%	0.4%	0.4%	0.4%	0.4%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
<u>Onstreet Parking Movements</u>												
% Time Lost per Hour	6.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<u>Parking Space Searching</u>												
% of Entering Traffic Searching for Parking Along Roadway	24%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Resulting Impact of Parking Traffic Moving at 20 mph	21.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<u>Conflicting Driveway Turning Movements</u>												
Number of Driveways	8	3	0	7	9	9	7	5	6	5	9	9
% Time Lost per Hour	15.0%	5.6%	0.0%	13.1%	16.9%	16.9%	13.1%	9.4%	11.3%	9.4%	16.9%	16.9%
<u>Truck Loading/Unloading</u>												
% Time Lost per Hour	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Total Multiplicative Reduction in Capacity</b>	51.2%	9.9%	10.5%	17.7%	18.7%	18.7%	16.1%	17.2%	21.6%	16.3%	19.4%	19.4%
<b>Resulting Roadway Capacity</b>	731	1,352	1,343	1,235	1,220	1,220	1,259	1,242	1,176	1,255	1,208	1,208
<u>Calculation of Value at Count Station East of SR 267 Corresponding to Capacity at Each Location</u>												
Existing Count On Segment	1,114	1,114	1,112	1,078	1,041	1,041	986	1,009	1,125	1,121	1,133	1,133
Existing Count - Just East of 267	1,160	1,160	1,160	1,160	1,160	1,160	1,120	1,120	1,120	1,120	1,120	1,120
Equivalent Capacity Just East of 267	1,398	1,398	1,391	1,317	1,339	1,339	1,393	1,353	1,171	1,254	1,195	1,195
Equivalent TRPA LOS=E Minimum (90% of Maximum Capacity)	1,258	1,252	1,185	1,205	1,254	1,254	1,217	1,217	1,054	1,129	1,076	1,076

- Similarly **bicyclists crossing the highway** are estimated to reduce capacity in Tahoe City by 2.8 percent.
- **Bicyclists** traveling along the travel lanes also tend to reduce roadway capacity, by causing drivers to hesitate or divert their travel path. This factor is estimated to reduce capacity in Tahoe City by 3 percent.
- **On-street parking maneuvers** impact roadway capacity, as a function of the number of spaces, the turnover rate of the spaces, and the time that traffic is interrupted as drivers enter and exit the spaces. Based on counts and observations made during peak summer conditions, this factor is estimated to reduce capacity in Tahoe City by 6.3 percent.
- **Searching for available on-street parking spaces** reduces capacity, as drivers tend to drive slower than otherwise, in order to avoid missing an available space. Counts conducted in Tahoe City indicate that 24 percent of all traffic entering on SR 28 is destined to the commercial core area. These drivers searching for parking tend to travel at approximately 20 miles per hour, which results in the entire traffic queue traveling at this speed under queued conditions. The *Highway Capacity Manual* indicates that the capacity of a roadway at 20 miles per hour is 21 percent below the capacity at 25 miles per hour.
- **Conflicting turning movements** also tend to reduce roadway capacity, as through drivers are delayed by left-turning drivers who do not fully pull into the center two-way left-turn lane, by right-turning drivers blocked by pedestrians or cyclists crossing the driveway, and by drivers entering the roadway that “force” their way into the traffic stream. Delays are often observed under queue conditions as through drivers politely wave drivers waiting on the side street into the traffic stream. This factor is estimated in Tahoe City to consume 15 percent of roadway capacity.
- Finally, in Tahoe City **truck loading and unloading activity** occurring in the center two-way left-turn lane sometimes causes additional delays (particularly from delivery trucks that are accessed on the side rather than the rear). This factor is estimated to result in a final reduction of 2 percent of capacity.

These various factors can be combined in a multiplicative fashion (1 - Factor A) X (1 - Factor B) X (1 - Factor C), etc. As shown in the bottom of Table 36, these factors together are estimated to reduce westbound roadway capacity in Tahoe City by 51.2 percent. Applying this reduction to the “ideal” capacity of 1,500 vehicles per hour results in a capacity of 731, which calibrates well with the observed westbound capacity of 730.

The capacity reduction impacts of many of these factors would be less in Kings Beach with a three-lane roadway than they are in Tahoe City. The lower levels of bicycle and pedestrian activity in Kings Beach result in lower capacity reductions than in Tahoe City. Similarly, the lower number of on-street parking spaces that would be available along each roadway segment results in less associated loss of capacity. For many roadway segments, the number of driveways is lower than in Tahoe City, resulting in a lower potential for turning-movement conflicts and associated loss in capacity. In addition, it can be expected that the higher number of side-street truck loading opportunities in Kings Beach would avoid the impact of loading activity found in Tahoe City. However, while the proportion of total traffic looking for parking is estimated (based on turning movement volumes) to be lower in Kings Beach, it is still sufficient enough to reduce the overall speed of the traffic queue.

The impacts of these various factors was estimated for the three potential constraining roadway segments in Kings Beach between Secline Street and Fox Street, and multiplied by the ideal capacity of 1,500 vehicles per hour per lane. As shown in Table 36, the critical segment in the eastbound direction would be the block between Secline Street and Deer Street with a capacity (adjusted to the count location) of 1,241 vehicles per hour. In the westbound direction, the critical segment is the block between Coon Street and Bear Street, with a capacity (adjusted to the count location) of 1,171 vehicles per hour. The factors having the greatest impacts on roadway capacity in Kings Beach are drivers searching for on-street parking spaces, conflicts with driveway turning movements, and pedestrians crossing the highway. A similar analysis of winter conditions was found to have substantially lower roadway capacity, due largely to the presence of on-street parking. The minimum eastbound capacity was found to equal 968 vehicles per hour, while minimum westbound capacity was found to equal 953 vehicles per hour, as shown in Table 37.

As an aside, one option that has been mentioned would be to widen the bike lanes on either side by two feet to improve traffic flow. As Alternative 2 and 4 do not include on-street parking, the only benefit that would be reflected in Table 36 would be a modest reduction in the friction factor associated with bicycle side friction. As this factor is less than 2 percent, a reduction in this factor would not have a material impact on the results of the analysis.

TABLE 37: Winter Capacity Analysis of Three-Lane SR 28 in Kings Beach With On-Street Parking on Both Sides													
	Observed Conditions: Tahoe City WB	Forecast Conditions: Kings Beach											
		Secline - Deer EB	Deer - Bear EB	Bear - Coon EB	Coon - Fox EB	Chipmunk EB	Chipmunk - Fox WB	-Coon WB	Fox	Coon - Bear WB	Bear - Deer WB	Secline WB	Deer - WB
<b>Ideal Capacity (At 25 mph)</b>	1,500	1500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
<b>Reductions in Capacity</b>													
<u>Pedestrian Crossing</u>													
# Pedestrian Crossings/Hour	167	9	7	3	6	13	13	6	3	7	9		
Pedestrians per Group	2	2	2	2	2	2	2	2	2	2	2		
# Pedestrian Groups per Hour	83	5	4	2	3	7	7	3	2	4	5		
Time Lost per Crossing (sec)	7	5	5	5	7	5	5	5	5	7	5		
Total Time Lost per Hour (sec)	583	22.5	17.5	7.5	21	32.5	32.5	15	7.5	24.5	22.5		
% Time Lost per Hour	16.2%	0.6%	0.5%	0.2%	0.6%	0.9%	0.9%	0.4%	0.2%	0.7%	0.6%		
<u>Bicycle Crossing</u>													
# Bicycle Crossings/Hour	25	0	0	0	0	0	0	0	0	0	0		
Time Lost per Crossing (sec)	4	2	2	2	2	2	2	2	2	2	2		
Total Time Lost per Hour (sec)	100	0	0	0	0	0	0	0	0	0	0		
% Time Lost per Hour	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%		
<u>Bicycle Side Friction</u>													
# Bicycles per Hour	35	1	1	1	1	1	3	3	3	3	3		
% Time Lost per Hour	3.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.3%	0.3%	0.3%	0.3%	0.3%		
<u>On-Street Parking Movements</u>													
# On-Street Spaces	25	10	16	25	9	15	17	13	11	12	4		
Average Parking Duration	1	1	1	1	1	1	1	1	1	1	1		
Entering Movements / Hour	25	10	16	25	9	15	17	13	11	12	4		
Exiting Movements / Hour	25	10	16	25	9	15	17	13	11	12	4		
Time Lost per Entering Mvmt (sec)	7	7	7	7	7	7	7	7	7	7	7		
Time Lost per Exiting Mvmt (sec)	2	2	2	2	2	2	2	2	2	2	2		
Total Time Lost per Hour (sec)	225	90	144	225	81	135	153	117	99	108	36		
% Time Lost per Hour	6.3%	2.5%	4.0%	6.3%	2.3%	3.8%	4.3%	3.3%	2.8%	3.0%	1.0%		
<u>Parking Space Searching</u>													
% of Entering Traffic Searching for Parking Along Roadway	24%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%		
Resulting Impact of Parking Traffic Moving at 20 mph	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%		
<u>Conflicting Driveway Turning Movements</u>													
Number of Driveways	8	8	3	0	7	9	7	5	6	5	9		
% Time Lost per Hour	15.0%	15.0%	5.6%	0.0%	13.1%	16.9%	13.1%	9.4%	11.3%	9.4%	16.9%		
<b>Total Multiplicative Reduction in Capacity</b>	51.2%	35.0%	28.8%	26.2%	33.3%	37.4%	35.0%	31.2%	32.2%	31.2%	35.6%		
<b>Resulting Roadway Capacity</b>	731	975	1,068	1,108	1,000	938	975	1,032	1,017	1,032	966		
<u>Calculation of Value at Count Station East of SR 267 Corresponding to Capacity at Each Location</u>													
Existing Count On Segment		1,181	1,124	1,115	1,075	1,035	841	867	976	967	980		
Existing Count - Just E of 267		1,174	1,174	1,174	1,174	1,174	967	967	967	967	967		
Equivalent Capacity Just E of 267		968	1,118	1,167	1,099	1,077	1,101	1,132	1,008	1,032	953		

## *Roadway Level of Service – 2008*

The 2008 volumes at the count location (by direction and by hour throughout the summer) can be calculated. Comparing the traffic volumes just east of the SR 267/SR 28 intersection shown in Table 17 for 2008 with those shown in Table 7 for 2002 indicates that volumes at this location will grow by 1.7 percent in the eastbound direction, and 1.8 percent westbound. These figures were used to factor the 2002 observed hourly volumes presented in Appendix A to yield the estimated hourly volumes for 2008 presented in Appendix D. These capacities were then compared with the observed directional traffic volumes by hour over the entire summer, to identify those hours during which volumes would exceed capacity (thereby resulting in the formation of traffic queues). A summary of this analysis for 2008 forecast traffic volumes is shown in Table 38. Note that this table presents information comparing traffic levels with both the absolute roadway capacity, as well as the TRPA LOS standard (LOS E for no more than 4 hours per day). In addition, Table 39 presents a calendar of the number of hours of each day in which traffic queues would form in 2008. A review of these tables yields the following conclusions for 2008 summer conditions:

- In the westbound direction, absolute roadway capacity would be exceeded resulting in the formation of slow-moving traffic queues along SR 28 during a total of 15 hours over the course of the summer. These hours would occur over five individual days, and up to 6 hours of traffic queues would occur on an individual day.
- In the eastbound direction, absolute roadway capacity would be exceeded during 28 hours of the summer. These hours will occur over the course of ten individual days. Up to 7 hours of queuing would occur on an individual day.
- As shown in Table 39, there would be a few days with queuing (in one or both directions) around the Fourth of July holiday. The majority of the remaining days with queuing would occur in the last few weeks of July and first few weeks of August, largely on Fridays and Saturdays in the eastbound direction, and Sundays in the westbound direction.
- When traffic queues form on SR 28, drivers can be expected to divert onto parallel local roads. As shown in the central portion of Table 38, under all of the hours in which diversion is forecast to occur, the diverted volume is expected to range to no more than 200 vehicles per hour.
- Eastbound traffic queues generated by the north Stateline pedestrian signal will not form back into Kings Beach at any time throughout the summer.
- The TRPA LOS standard has two criteria: whether the peak hour is LOS E or better, and whether no more than 4 hours per day exceed LOS D. In the eastbound direction, the peak hour exceeds LOS E on ten days, while the number of days per year with more than 4 hours exceeding LOS D is 6. Taking the higher of these two numbers, the TRPA LOS standard is exceeded on ten days per year. In the westbound direction, the peak hour exceeds LOS E on five days, while the number of days per year with more than 4 hours exceeding LOS D is 4, indicating that the TRPA LOS standard is exceeded five days per year.

As hourly directional traffic volumes in the winter are not available over numerous days, the winter roadway LOS analysis was confined to a single peak day (specifically the Friday after New Years). As shown in Table 40, under Alternative 2 absolute roadway capacity would be exceeded for 3 hours in the eastbound direction, and 1 hour in the westbound direction. An analysis comparing volumes with the TRPA LOS roadway capacity, as shown in Table 41, indicates that the TRPA standard would be exceeded in both directions in 2008 in winter.

**TABLE 38: Summary of 2008 Traffic Queuing With Three-Lane SR 28 – with No SR 28 On-Street Parking (Alternatives 2,4)**

	Direction of Travel				
	Eastbound	Westbound	Both		
# Days per Summer On Which Queuing Would Occur	10	5	2		
# Hours per Summer of Queuing	28	15	8		
<u>Average Daily Hours of Queuing</u>					
- On Fridays in August	1.6	0.0	--		
- On Saturdays in August	1.0	0.0	--		
- On Sundays in August	0.0	1.0	--		
- On Other Weekdays in August	0.1	0.0	--		
Maximum # of Hours of Queuing per Day	7	6	--		
<b>Number of Days Per Summer On Which Queuing Would Occur By # of Hours Per Day</b>					
	# Hours of Queuing per Day	Eastbound	Westbound		
	0	99	104	--	
	1	1	2	--	
	2	4	0	--	
	3	4	1	--	
	4	0	1	--	
	5	0	0	--	
	6	0	1	--	
	7	1	0	--	
	8	0	0	--	
Number of Summer Hours When North Stateline Creates Eastbound Queues Forming Back into Kings Beach	0	--			
<b>Number of Summer Hours of Diverted Traffic Volume</b>					
	(One-Way Vehicles per Hour)		Hours per Summer		
	From	To	Eastbound	Westbound	
	1	100	21	11	--
	101	200	7	4	--
	201	300	0	0	--
	Total		28	15	--
<u><b>TRPA LOS ANALYSIS</b></u>					
1. Number of Days Per Summer on Which TRPA LOS E Standard Would be Exceeded For At Least 1 Hour	10	5	2		
Number of Days Per Summer On Which TRPA LOS D Standard Would be Exceeded by # of Hours per Day					
	# Hours of LOS F	Eastbound	Westbound		
	0	67	84	--	
	1	7	11	--	
	2	16	7	--	
	3	9	0	--	
	4	4	3	--	
	5	2	1	--	
	6	1	1	--	
	7	2	1	--	
	8	1	1	--	
	9	0	0	--	
2. Number of Days Per Summer on Which TRPA LOS D Standard is Exceed More than 4 Hours	6	4	--		
Number of Days Per Summer on Which TRPA Standard is Exceeded (Maximum of #1 or #2)	10	5	--		

**TABLE 39: 2008 Calender of Summer Hours of Traffic Queues  
with Three-Lane SR 28 (Alternatives 2, 4)**

Week Beginning	Day of the Week						
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
<u>Eastbound Daily Hours of Traffic Queue</u>							
09-Jun							
16-Jun							
23-Jun							
30-Jun				3		7	2
07-Jul							
14-Jul							
21-Jul						3	3
28-Jul						1	
04-Aug					2	3	2
11-Aug						2	
18-Aug							
25-Aug							
01-Sep							
08-Sep							
15-Sep							
<u>Westbound Daily Hours of Traffic Queue</u>							
09-Jun							
16-Jun							
23-Jun							
30-Jun						6	4
07-Jul							
14-Jul							
21-Jul							
28-Jul	3						1
04-Aug							
11-Aug	1						
18-Aug							
25-Aug							
01-Sep							
08-Sep							
15-Sep							

**TABLE 40: Winter SR 28 Roadway Capacity Analysis**

Peak Winter Day

Time		2008 Analysis										2028 Analysis									
		Balance (Capacity Minus Demand)					Balance (Capacity Minus Demand)					Balance (Capacity Minus Demand)					Balance (Capacity Minus Demand)				
		Demand		Alternative 2		Alternative 4	Demand		Alternative 2		Alternative 4	Demand		Alternative 2		Alternative 4	Demand		Alternative 2		Alternative 4
Begin	Time End	EB	WB	EB	WB		EB	WB	EB	WB		EB	WB	EB	WB		EB	WB	EB	WB	
<b>Roadway Capacity</b>																					
12:00	- 1:00	85	134	883	819	1174	1259	953	968	819	1174	1089	1223	968	738	953	968	738	1131	1259	1223
01:00 AM	- 02:00 AM	32	50	936	903	1227	1173			903	1227	1173			840			840	1131		
02:00 AM	- 03:00 AM	23	46	945	907	1236	1177			907	1236	1177			921			921	1212		
03:00 AM	- 04:00 AM	9	33	959	920	1250	1190			920	1250	1190			933			933	1224		
04:00 AM	- 05:00 AM	23	32	945	921	1236	1191			921	1236	1191			954			954	1245		
05:00 AM	- 06:00 AM	49	79	919	874	1210	1144			874	1210	1144			933			933	1224		
06:00 AM	- 07:00 AM	166	284	802	669	1093	939			669	1093	939			895			895	1186		
07:00 AM	- 08:00 AM	363	701	605	252	896	522			252	896	522			720			720	1011		
08:00 AM	- 09:00 AM	477	845	491	108	782	378			108	782	378			425			425	716		
09:00 AM	- 10:00 AM	569	798	399	155	690	425			155	690	425			254			254	545		
10:00 AM	- 11:00 AM	610	868	358	85	649	355			85	649	355			117			117	408		
11:00 AM	- 12:00 PM	675	907	293	46	584	316			46	584	316			55			55	346		
12:00 PM	- 01:00 PM	775	838	193	115	484	385			115	484	385			-43			-43	248		
01:00 PM	- 02:00 PM	777	791	191	162	482	432			162	482	432			-192			-192	99		
02:00 PM	- 03:00 PM	831	814	137	139	428	409			139	428	409			-195			-195	96		
03:00 PM	- 04:00 PM	1005	904	-37	49	254	319			49	254	319			-275			-275	16		
04:00 PM	- 05:00 PM	1194	967	-226	-14	65	256			-14	65	256			-496			-496	-245		
05:00 PM	- 06:00 PM	1105	787	-137	166	154	436			166	154	436			-710			-710	-419		
06:00 PM	- 07:00 PM	725	605	243	348	534	618			348	534	618			-686			-686	-395		
07:00 PM	- 08:00 PM	478	458	490	495	781	765			495	781	765			-117			-117	174		
08:00 PM	- 09:00 PM	361	344	607	609	898	879			609	898	879			253			253	544		
09:00 PM	- 10:00 PM	352	323	616	630	907	900			630	907	900			428			428	719		
10:00 PM	- 11:00 PM	305	274	663	679	954	949			679	954	949			441			441	732		
11:00 PM	- 12:00 PM	201	191	767	762	1058	1032			762	1058	1032			511			511	802		
															667			667	958		

**TABLE 41: Winter Evaluation of Three-Lane Roadway Periods Exceeding TRPA LOS Standard**

Peak Winter Day

Time Begin	Time End	2008 Analysis										2028 Analysis											
		Demand					Balance (Capacity Minus Demand)					Demand					Balance (Capacity Minus Demand)						
		EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB		
																						Alternative 2	Alternative 4
Roadway Capacity																							
12:00	- 1:00	85	134	871	858	1133	1101	871	858	1133	1101	128	215	871	858	1133	1101	128	215	871	858	1133	1101
01:00 AM	- 02:00 AM	32	50	839	808	1101	1051	743	778	1086	1021	47	80	824	778	1086	1021	47	80	824	778	1086	1021
02:00 AM	- 03:00 AM	23	46	848	812	1110	1055	836	785	1098	1028	35	73	836	785	1098	1028	35	73	836	785	1098	1028
03:00 AM	- 04:00 AM	9	33	862	825	1124	1068	857	806	1119	1049	14	52	857	806	1119	1049	14	52	857	806	1119	1049
04:00 AM	- 05:00 AM	23	32	848	826	1110	1069	836	807	1098	1050	35	51	836	807	1098	1050	35	51	836	807	1098	1050
05:00 AM	- 06:00 AM	49	79	822	779	1084	1022	798	731	1060	974	73	127	798	731	1060	974	73	127	798	731	1060	974
06:00 AM	- 07:00 AM	166	284	705	574	967	817	623	403	885	646	248	455	623	403	885	646	248	455	623	403	885	646
07:00 AM	- 08:00 AM	363	701	508	157	770	400	328	-266	590	-23	543	1124	328	-266	590	-23	543	1124	328	-266	590	-23
08:00 AM	- 09:00 AM	477	845	394	13	656	256	157	-497	419	-254	714	1355	157	-497	419	-254	714	1355	157	-497	419	-254
09:00 AM	- 10:00 AM	569	798	302	60	564	303	20	-421	282	-178	851	1279	20	-421	282	-178	851	1279	20	-421	282	-178
10:00 AM	- 11:00 AM	610	868	261	-10	523	233	-42	-534	220	-291	913	1392	-42	-534	220	-291	913	1392	-42	-534	220	-291
11:00 AM	- 12:00 PM	675	907	196	-49	458	194	-140	-596	122	-353	1011	1454	-140	-596	122	-353	1011	1454	-140	-596	122	-353
12:00 PM	- 01:00 PM	775	838	96	20	358	263	-289	-485	-27	-242	1160	1343	-289	-485	-27	-242	1160	1343	-289	-485	-27	-242
01:00 PM	- 02:00 PM	777	791	94	67	356	310	-292	-410	-30	-167	1163	1268	-292	-410	-30	-167	1163	1268	-292	-410	-30	-167
02:00 PM	- 03:00 PM	831	814	40	44	302	287	-372	-448	-110	-205	1243	1306	-372	-448	-110	-205	1243	1306	-372	-448	-110	-205
03:00 PM	- 04:00 PM	1005	904	-134	-46	128	197	-633	-591	-371	-348	1504	1449	-633	-591	-371	-348	1504	1449	-633	-591	-371	-348
04:00 PM	- 05:00 PM	1194	967	-323	-109	-61	134	-807	-692	-545	-449	1678	1550	-807	-692	-545	-449	1678	1550	-807	-692	-545	-449
05:00 PM	- 06:00 PM	1105	787	-234	71	28	314	-783	-404	-521	-161	1654	1262	-783	-404	-521	-161	1654	1262	-783	-404	-521	-161
06:00 PM	- 07:00 PM	725	605	146	253	408	496	-214	-111	48	132	1085	969	-214	-111	48	132	1085	969	-214	-111	48	132
07:00 PM	- 08:00 PM	478	458	393	400	655	643	156	124	418	367	715	734	156	124	418	367	715	734	156	124	418	367
08:00 PM	- 09:00 PM	361	344	510	514	772	757	331	306	593	549	540	552	331	306	593	549	540	552	331	306	593	549
09:00 PM	- 10:00 PM	352	323	519	535	781	778	344	341	606	584	527	517	344	341	606	584	527	517	344	341	606	584
10:00 PM	- 11:00 PM	305	274	566	584	828	827	414	419	676	662	457	439	414	419	676	662	457	439	414	419	676	662
11:00 PM	- 12:00 PM	201	191	670	667	932	910	570	551	832	794	301	307	570	551	832	794	301	307	570	551	832	794
# Hours LOS E Exceeded		3	1	3	1	0	0	8	12	3	10			8	12	3	10			8	12	3	10
# Hours of LOS E or F		3	4	3	4	1	0	9	12	6	11			9	12	6	11			9	12	6	11
TRPA LOS Standard Exceeded?		YES	YES	YES	YES	NO	NO	YES	YES	YES	YES			YES	YES	YES	YES			YES	YES	YES	YES

## Post-Project Roadway Level of Service – 2028

Comparing the 2008 traffic volumes just east of the SR 267/SR 28 intersection shown in Table 25 with those shown in Table 7 for 2002, factors were developed and applied to 2002 observed hourly volumes presented in Appendix A to yield the estimated summer hourly volumes for 2028 presented in Appendix E. These capacities were then compared with the observed directional traffic volumes by hour over the entire summer to identify those hours during which volumes would exceed capacity (thereby resulting in the formation of traffic queues). A summary of this analysis for 2028 forecast is shown in Table 42. In addition, Table 43 presents a calendar of the number of hours of each day in which traffic queues would form in 2008. A review of these tables yields the following conclusions for 2028 conditions.

- In the westbound direction, roadway capacity would be exceeded (resulting in LOS F and the formation of slow-moving traffic queues along SR 28) during a total of 774 hours over the course of the summer. These hours would occur over virtually all days of the summer, and up to 11 hours of traffic queues would occur on an individual day.
- In the eastbound direction, roadway capacity would be exceeded (LOS F) during 670 hours of the summer. These hours will occur over the course of 104 individual days. Up to 11 hours of LOS F queuing would occur on an individual day.
- As shown in Table 43, the days with a particularly high number of hours of queuing (in one or both directions) start around the Fourth of July holiday, and continue into mid-August.
- As shown in the central portion of Table 42, the diverted volume is expected to range up to between 400 and 500 vehicles per hour in the eastbound direction (for 124 hours per summer), and 500 to 600 vehicles per hour in the westbound direction (for 144 hours per summer).
- Eastbound traffic queues generated by the north Stateline pedestrian signal will form back into Kings Beach during 69 hours per summer. Subtracting this figure from the 670 total hours of eastbound queuing per summer, this roadway alternative in Kings Beach would generate 601 additional hours of queues over and above the 69 hours resulting from the north Stateline signal.
- The TRPA LOS standard has two criteria: whether the peak hour is LOS E or better, and whether no more than 4 hours per day exceed LOS D. In the eastbound direction, the peak hour exceeds LOS E on 104 days, while the number of days per summer with more than 4 hours exceeding LOS D is 92. Taking the higher of these two numbers, the TRPA LOS standard would be exceeded on 104 days per summer. In the westbound direction, the peak hour exceeds LOS E on 108 days, while the number of days per year with more than 4 hours exceeding LOS D is 105, indicating that the TRPA LOS standard is exceeded 108 days per summer.

LOS analysis of a peak winter day for Alternative 2 is presented in the right-hand portions of Tables 40 and 41. As shown in Table 40, absolute capacity would be exceeded during 8 hours in the eastbound direction, and 12 hours in the westbound direction. In addition LOS would be below LOS D for 9 hours eastbound and 12 hours westbound, as shown in Table 41. TRPA LOS standards would therefore be exceeded.

**TABLE 42: Summary of 2028 Summer Traffic Queuing with Three-Lane SR 28 – With No SR 28 On-Street Parking (Alternatives 2, 4)**

	Direction of Travel				
	Eastbound	Westbound	Both		
# Days per Summer On Which Queuing Would Occur	104	108	104		
# Hours per Summer of Queuing	670	774	651		
<u>Average Daily Hours of Queuing</u>					
- On Fridays in August	8.8	9.2	--		
- On Saturdays in August	8.6	9.4	--		
- On Sundays in August	7.8	9.8	--		
- On Other Weekdays in August	7.1	7.8	--		
Maximum # of Hours of Queuing per Day	11	11	--		
<b>Number of Days Per Summer On Which Queuing Would Occur By # of Hours Per Day</b>					
	# Hours of Queuing per Day	Eastbound	Westbound		
	0	4	0	--	
	1	0	0	--	
	2	4	3	--	
	3	19	12	--	
	4	3	4	--	
	5	8	8	--	
	6	11	11	--	
	7	22	11	--	
	8	14	19	--	
	9	20	32	--	
	10	3	6	--	
	11	1	3	--	
	12	0	0	--	
<b>Number of Summer Hours When North Stateline Creates Eastbound Queues Forming Back into Kings Beach</b>					
	0	--			
<b>Number of Summer Hours of Diverted Traffic Volume</b>					
	Diverted Traffic Volume (1-Way Vehicles per Hour)		Hours per Summer		
	From	To	Eastbound	Westbound	
	1	100	146	164	--
	101	200	152	191	--
	201	300	135	152	--
	301	400	113	123	--
	401	500	124	144	--
	501	600	0	0	--
	Total		670	774	--
<b><u>TRPA LOS ANALYSIS</u></b>					
<b>1. Number of Days Per Summer on Which TRPA LOS E Standard Would be Exceeded For At Least 1 Hour</b>					
	104	108	--		
Number of Days Per Summer On Which TRPA LOS E Standard Would be Exceeded by # of Hours per Day					
	# Hours of LOS F	Eastbound	Westbound		
	0	0	0	--	
	1	1	0	--	
	2	1	0	--	
	3	6	1	--	
	4	9	3	--	
	5	6	6	--	
	6	7	5	--	
	7	13	11	--	
	8	18	10	--	
	9	25	33	--	
	10	14	22	--	
	11	4	17	--	
	12	4	0	--	
	13	1	1		
	14	0	0		
<b>2. Number of Days Per Summer on Which TRPA LOS D Standard is Exceeded More than 4 Hours</b>					
	92	105	--		
<b>Number of Days Per Summer on Which TRPA Standard is Exceeded (Maximum of #1 or #2)</b>					
	104	108	--		

**TABLE 43: 2028 Calender of Summer Hours of Traffic Queues  
with Three-Lane SR 28 (Alternatives 2, 4)**

Week Beginning	Day of the Week						
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
<u>Eastbound Daily Hours of Traffic Queue</u>							
09-Jun	0	3	3	3	3	5	5
16-Jun	0	3	3	4	3	6	8
23-Jun	6	4	5	3	6	8	7
30-Jun	7	7	7	10	9	11	10
07-Jul	7	6	7	6	7	8	9
14-Jul	7	6	7	6	7	9	9
21-Jul	7	7	7	8	8	9	9
28-Jul	9	7	8	7	8	9	9
04-Aug	9	8	8	9	9	9	9
11-Aug	8	9	9	8	10	9	9
18-Aug	9	7	7	7	7	8	8
25-Aug	5	3	4	3	5	7	9
01-Sep	8	5	3	3	3	5	5
08-Sep	0	3	3	2	3	6	7
15-Sep	0	3	2	2	3	6	7
<u>Westbound Daily Hours of Traffic Queue</u>							
09-Jun	5	4	3	3	3	7	6
16-Jun	6	4	5	5	5	8	7
23-Jun	8	6	5	5	7	7	8
30-Jun	8	8	8	10	9	11	10
07-Jul	9	8	7	8	8	9	8
14-Jul	9	8	8	7	8	9	9
21-Jul	8	9	8	8	9	9	10
28-Jul	11	9	9	9	9	9	9
04-Aug	10	9	9	9	9	10	10
11-Aug	11	9	9	9	9	9	9
18-Aug	9	8	7	8	9	9	9
25-Aug	8	5	6	3	5	6	9
01-Sep	9	9	6	3	3	6	6
08-Sep	4	3	2	3	3	6	7
15-Sep	3	4	3	3	3	7	7

## Post-Project Traffic Volumes on Residential Streets – 2008 and 2028

When traffic volumes exceed roadway capacity, drivers faced by resulting delays can be expected to divert off of the state highway system onto local streets. Due to the grid nature of the Kings Beach local streets, there are numerous potential options that individual drivers may choose. Key factors that will influence driver's decisions would consist of the following.

In the **eastbound** direction, key factors that will influence driver's decisions would consist of the following:

- The key eastbound “choke point” is expected to be the block between Secline Street and Deer Street. Eastbound traffic queues can be expected to form starting in this block, with the “tail” of the queue forming back to the west, through the SR 28/267 intersection in both the eastbound and southbound directions.
- As this tail forms past Secline Street, impatient drivers (particularly those familiar with the local roadway network) can be expected to turn left onto Secline Street and right onto Rainbow Avenue. While there are a variety of potential diversion travel paths, it can further be expected that the majority of drivers will continue east on Rainbow Avenue and south on Coon Street to SR 28, as the Coon/28 roundabout would provide relatively easy southbound left-turns onto SR 28 eastbound.
- The eastbound block between Fox and Chipmunk, however, is a second “choke point” with a capacity slightly lower than between Secline and Deer. (As traffic volumes tend to decline from west to east, this eastern segment would reach capacity first even though the western segment has a lower capacity). Drivers returning to SR 28 eastbound at Coon and Fox would face a second area of congestion. As a result, drivers would tend to use Salmon Street and Chipmunk Street, even though this route requires a difficult left turn onto SR 28. Other drivers could decide to cross SR 28 at Coon Street (using the roundabout), and travel eastbound on Brockway Vista Avenue to return to SR 28 at Chipmunk Street, which allows an easy right-turn onto the highway.
- Southbound drivers on SR 267 approaching Kings Beach that are aware of the periods when there is congestion on SR 28 can be expected to use Speckled Avenue or Dolly Varden Avenue to enter the local street grid.
- Of these drivers using Speckled or Dolly Varden, some would use Coon Street or Fox Street to travel to the south. Other drivers would find Cutthroat Avenue and Beaver Street to be the more convenient through route. While Beaver Street is relatively narrow and has more grades, it also has fewer Stop signs.

In the **westbound** direction, key factors that will influence driver's decisions would consist of the following:

- The key chock point is expected to be along the block between Coon Street and Bear Street. Once this queue forms back eastward to Coon Street, it can be expected that drivers will begin to divert north on Coon Street. As westbound drivers at Coon Street will be near the end of the congestion, however, diversions onto Coon Street can be expected to be relatively few.
- Instead, the greater diversion can be expected to occur at Fox Street and Chipmunk Street, as these drivers would be provided with a greater time savings. In particular, Chipmunk Street

provide the first opportunity in the westbound direction to divert from a westbound SR 28 traffic queue onto relatively flat local roadways.

- In particularly high volume traffic periods and when a high proportion of drivers are unaware of local street route options, the westbound travel queue can be expected to form back east of Beaver Street. When this occurs, Beaver Street will provide the first opportunity to leave the queue, and will be particularly attractive for those drivers familiar with the local roadway network that are heading to SR 267 to the north.
- Once in the local roadway network on either Coon Street or Fox Street, drivers destined to SR 28 west of SR 267 can be expected to use either Trout Avenue or Rainbow Avenue (as Brook Avenue will be one-way eastbound). Drivers destined to SR 267 to the north can be expected to continue north on Coon or Fox, using Dolly Varden Avenue or Speckled Avenue to return to SR 267, rather than returning first to SR 28.

Figure 6 presents these various diversion routes, while Table 44 presents forecasts of summer ADT volumes on residential streets considering the impacts of these diversion paths for an average Saturday in August. The street segments representing the edges of the residential neighborhood (where existing volumes are highest) were the focus of this analysis. Comparing Alternative 2 volumes with Alternative 1 (no project), Alternative 2 is not forecast to generate increases in ADT in 2008. However, by 2028, substantial ADT would be generated by diverted traffic, particularly on Fox Street between Minnow and Salmon (5,400 ADT), Fox Street between Brook and Trout (4,700 ADT), and Chipmunk Street between SR 28 and Minnow Avenue (4,000 ADT). Other streets where Alternative 2 would increase ADT over 2,000 include Rainbow Avenue (Secline to Deer), Bear (Trout to Rainbow), Coon (Trout to Rainbow), Speckled (Secline to Deer) and Dolly Varden (Secline to Deer). Based on these results, it can be expected that many other residential street segments would also experience substantial increases in traffic levels due to diverted traffic in 2028.

#### Post-Project Consistency with Traffic Signal Warrants

The signal warrant analysis for Alternative 2 does not differ from that of Alternative 1, as shown in Table 32 and Table 33, for 2008 and 2028 conditions, respectively. Multiple warrants would be met at all study intersections, including the roundabout locations proposed under Alternative 2, in both 2008 and 2028.

#### *Summary of Significant Impacts*

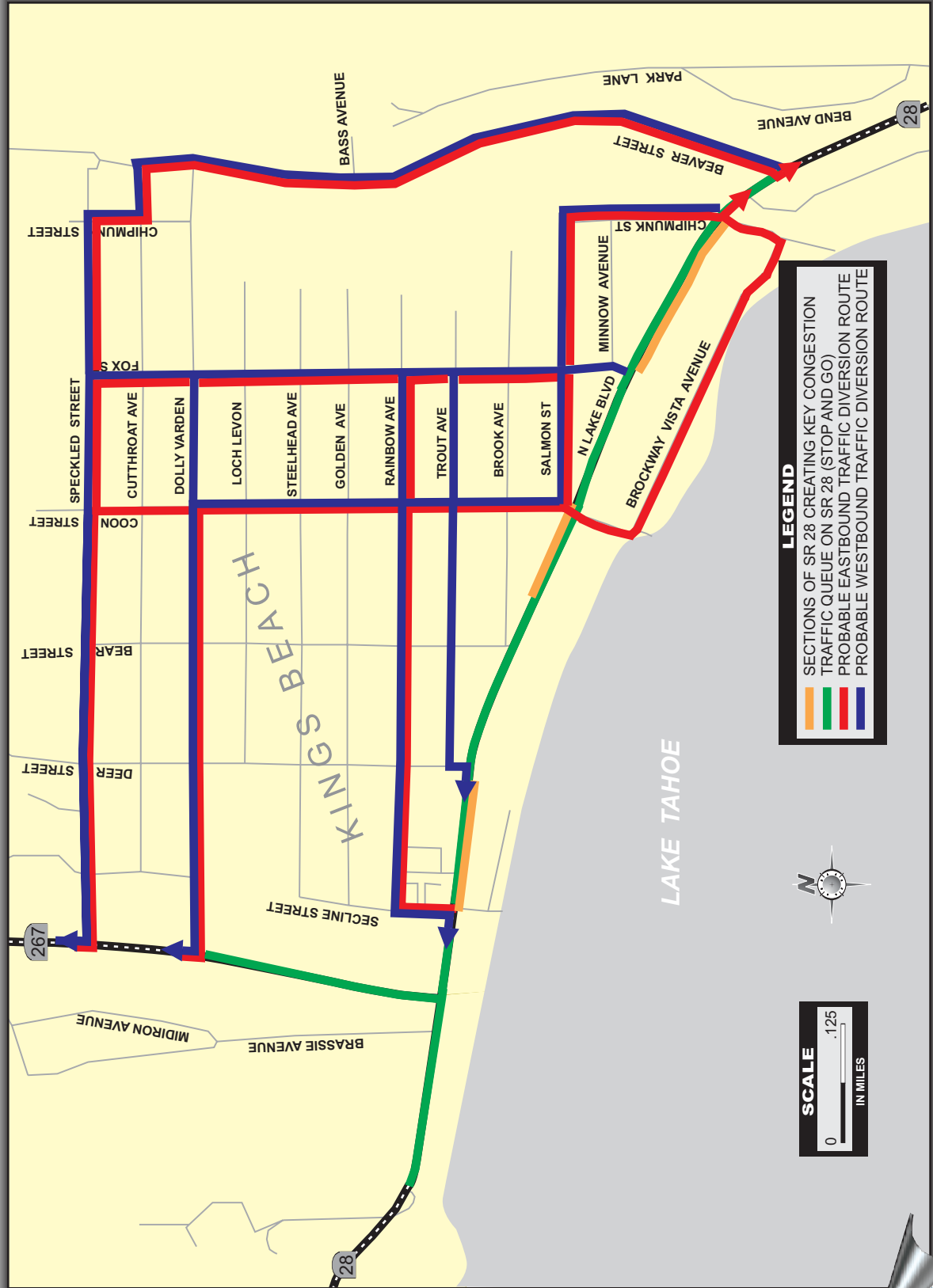
Impacts from this alternative that have potential to exceed the criteria identified in Section 1 are summarized below. Measures to avoid, minimize, and mitigate these significant impacts are identified in Section 4.

#### *SR 28 Roadway LOS*

As a result of implementation of Alternative 2, there is the potential to exceed the TRPA standard of no more than 4 hours per day of LOS E on SR 28 in Kings Beach:

- In 2008, the TRPA LOS roadway standard would be exceeded on ten days per summer in the eastbound direction, and five days per summer in the westbound direction. TRPA LOS standards would also be exceeded on a peak winter day, in both directions. TRPA standards do not identify how many days per year or per season are required to be considered a significant impact. (As traffic

**FIGURE 6**  
**KEY ROUTES OF DRIVERS AVOIDING SR 28 CONGESTION**  
**UNDER ALTERNATIVES 2 AND 4**



**TABLE 44: Total Two-Way Daily Traffic Volume on Neighborhood Streets – Average August Saturday**

**Bold** Indicates Alternative Resulting in Increase in ADT Exceeding Standard of 3,000

Roadway Name	Segment Description	ADT for a Typical Saturday in August							
		2008				2028			
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Rainbow Ave	Secline St. to Deer St.	600	600	600	600	800	2,800	800	2,800
Deer St.	Trout Ave. to Rainbow Ave.	700	700	700	700	1,100	1,100	1,100	1,100
Bear St.	Trout Ave. to Rainbow Ave.	1,300	1,600	1,600	1,600	2,100	2,100	2,100	2,100
Coon St.	Trout Ave. to Rainbow Ave.	1,000	900	900	900	1,200	2,900	1,200	2,900
Fox St.	Minnow Ave. to Salmon St.	2,000	2,000	2,000	2,000	2,800	<b>5,400</b>	2,800	<b>5,400</b>
Fox St.	Brook Ave. to Trout Ave.	1,100	1,100	1,100	1,100	1,500	<b>4,700</b>	1,500	<b>4,700</b>
Chipmunk St.	SR 28 to Minnow Ave.	800	800	800	800	1,300	<b>4,000</b>	1,300	<b>4,000</b>
Speckled Ave.	Secline St. to Deer St.	600	600	600	600	1,000	2,700	1,000	2,700
Speckled Ave.	Coon St. to Fox St.	300	300	300	300	500	1,300	500	1,300
Dolly Varden Ave.	Secline St. to Deer St.	400	400	400	400	500	2,200	500	2,200
Dolly Varden Ave.	Coon St. to Fox St.	200	200	200	200	200	800	200	800
Beaver Street	SR 28 to Cutthroat	600	600	600	600	600	1,700	600	1,700

studies generally do not evaluate multiple days per season, this issue is not usually raised.) Standard traffic engineering practice is to not establish significance based upon a single peak hour or peak day, but rather to consider a “typical peak” condition (such as the 30th-highest volume in a year). For a seasonal daily standard, the 10th-highest day is assumed to be applicable for purposes of this study. Based upon this, LOS impacts in 2008 in the eastbound direction are considered to be **significant**.

- In 2028, the TRPA LOS would be exceeded every one of the 108 days in the summer season in the westbound direction, and 104 days per summer season in the eastbound direction, as well as in both directions on a peak winter day. This impact is considered **significant**.

### *Residential Streets*

As a result of implementation of Alternative 2, there is the potential to exceed the standard of no more than 3,000 ADT on a residential street. This standard is not expected to be exceeded in 2008. However, by 2028 this standard is forecast to be exceeded on portions of Fox Street (up to 5,400 ADT) and Chipmunk Street (up to 4,000 ADT). This impact is considered **significant**.

### *Intersection Level of Service*

The proposed single-lane configurations would provide unacceptable LOS F conditions on the worst (SR 28) approaches at Bear Street in 2008 and 2028, and at Coon Street in 2028. Long queues would form that would block other public street intersections along SR 28. In addition, the SR 267/SR 28 signalized intersection would provide unacceptable LOS F conditions in 2028. This would be a **significant** impact.

## 3.2 Impacts of Alternative 3

This alternative is proposed to consist of four through travel lanes along SR 267 with traffic signals at SR 267, at Bear Street, and at Coon Street. New left-turn lanes along SR 28 would be provided at Bear Street, Coon Street, and Fox Street. Brook Avenue would be converted to one-way eastbound from Bear Street to Coon Street.

### Post-Project Intersection Level of Service

The traffic volumes presented in Tables 17, 18, 25, and 26 were analyzed were analyzed using *Highway Capacity Manual* methodologies, assuming the roadway configuration of Alternative 3.

### *Intersection Level of Service – 2008*

Table 45 presents the summer intersection LOS results for 2008 conditions. These conditions consist of the following:

- The Stop sign controlled intersections along SR 28 at Secline and Fox Streets) will provide poor (LOS F) conditions for side street approaches to the state highway in 2008. Adequate (LOS C) conditions would be provided at Deer Street and Chipmunk Street.
- The signals at the Bear Street and Coon Street intersections will provide LOS A and LOS B conditions in 2008, respectively.
- At the SR 267/SR 28 intersection, LOS C will be provided by the signal.

TABLE 45: 2008 Peak Hour Intersection LOS – Alternative 3					
SR 28 @	Traffic Control	Worst Approach		Total Intersection	
		(s/veh)	LOS	(s/veh)	LOS
Summer					
SR 267	Signal	—	—	24.1	C
Secline Street	Two-Way Stop Controlled	53.3	F	—	—
Deer Street	Two-Way Stop Controlled	15.5	C	—	—
Bear Street	Signal	—	—	7.5	A
Coon Street	Signal	—	—	15.3	B
Fox Street	Two-Way Stop Controlled	113.0	F	—	—
Chipmunk Street	Two-Way Stop Controlled	20.2	C	—	—
Winter					
SR 267	Signal	—	—	37.8	D
Secline Street (1)	Two-Way Stop Controlled	40.8	E	—	—
Deer Street	Two-Way Stop Controlled	24.2	C	—	—
Bear Street	Signal	—	—	7.3	A
Coon Street	Signal	—	—	15.1	B
Fox Street	Two-Way Stop Controlled	97.7	F	—	—
Chipmunk Street	Two-Way Stop Controlled	22.2	C	—	—

- Winter peak day LOS will be similar to summer LOS, except that LOS D would be provided at SR 267 and LOS E would be provided on the worst approach at Secline Street.

#### *Intersection LOS – 2028*

Table 46 presents the intersection LOS results for 2028 conditions. These conditions consist of the following:

- The Stop sign controlled intersections along SR 28 (Secline, Deer, Fox and Chipmunk Streets) will provide poor (LOS F) conditions for side street approaches to the state highway in 2028.
- At the Bear Street and Coon Street intersections, the signals will provide LOS B conditions in 2028.
- At the SR 267/SR 28 intersection, the existing signalized configuration would provide LOS F conditions in 2028. Provision of a separate westbound right-turn lane would be required to provide an adequate (D) LOS.

The results of the winter LOS analysis parallel those of the summer analysis, with the exception that LOS at the Coon Street signal would be C. A separate westbound right-turn lane is also required to provide an adequate (no more than 4 hours per day of E) LOS in the winter.

#### Post-Project Roadway Level of Service – 2008 and 2028

To analyze roadway LOS under this roadway configuration, the *Highway Capacity Manual* methodology for urban arterials was applied. Under this methodology, LOS is a measure of total travel speed through the corridor. For the summer design period in the peak direction, LOS B was found for 2008 conditions in the peak direction, with a travel speed of 30.5 miles per hour. For the summer design period, LOS E was found for 2028 conditions in the peak direction, with a travel speed of 16.3 miles per hour.

TABLE 46: 2028 Peak Hour Intersection LOS – Alternative 3					
SR 28 @	Existing Traffic Control	Worst Approach		Total Intersection	
		(s/veh)	LOS	(s/veh)	LOS
<b>Summer</b>					
<u>Existing Intersection Configuration (Unmitigated)</u>					
SR 267	Signal	—	—	154.9	F
Secline Street	Two-Way Stop Controlled	356.4	F	—	—
Deer Street	Two-Way Stop Controlled	546.6	F	—	—
Bear Street	Signal	—	—	11.9	B
Coon Street	Signal	—	—	18.8	B
Fox Street	Two-Way Stop Controlled	554.1	F	—	—
Chipmunk Street	Two-Way Stop Controlled	65.8	F	—	—
<u>Required Intersection Configuration (Mitigated)</u>					
SR 267	Signal	—	—	53.2	D
Requires Separate Westbound Right-Turn Lane					
<b>Winter</b>					
SR 267	Signal	—	—	188.6	F
Secline Street (1)	Two-Way Stop Controlled	333.2	F	—	—
Deer Street	Two-Way Stop Controlled	(1)	F	—	—
Bear Street	Signal	—	—	11.5	B
Coon Street	Signal	—	—	22.6	C
Fox Street	Two-Way Stop Controlled	(1)	F	—	—
Chipmunk Street	Two-Way Stop Controlled	66.2	F	—	—
<b>Required Intersection Configuration (Mitigated)</b>					
SR 267	Signal	—	—	74.2	E
Requires Separate Westbound Right-Turn Lane					
separate right-turn lanes on the southbound approaches.					
Note 1: Delay level too high to calculate					

Winter roadway LOS is found to be LOS B (29.6 mph) in 2008, and LOS E (13.8 mph) in 2028. As the 5th-highest 2028 peak direction hourly volume over the 2028 design day is 23 percent below the peak volume, it can be concluded that the TRPA LOS standard (no more than 4 hours below LOS D) is attained. Roadway LOS is therefore found to attain standards in both 2008 and 2028.

#### Post-Project Traffic Volumes on Residential Streets – 2008 and 2028

As SR 28 roadway volumes would not exceed capacity, and as intersections (with mitigation) would not generate significant delays, no significant diversion of traffic onto residential streets would occur with this alternative in both 2008 and 2028 as shown in Table 44.

#### Post-Project Consistency with Traffic Signal Warrants – 2008 and 2028

The signal warrant analysis for Alternative 3 does not differ from that of Alternative 1, as shown in Table 32 and Table 33, for 2008 and 2028 conditions, respectively. The signal locations proposed under Alternative 3 therefore directly correspond with those locations identified as meeting traffic signal warrants in both 2008 and 2028.

## Summary of Significant Impacts

### *Intersection Level of Service*

The existing configuration of the SR 28/SR 267 intersection would provide unacceptable LOS F conditions in 2028 (but not in 2008). This would be a **significant** impact.

### 3.3 Impacts of Alternative 4

This alternative is identical to Alternative 2, except that no on-street parking spaces would be provided along SR 28, effectively prohibiting on-street parking year round rather than solely in the summer.

### Post-Project Intersection Level of Service – 2008 and 2028

From a traffic perspective, this alternative only differs from Alternative 2 in that on-street mid-block parking would be prohibited in the winter. As this does not materially impact intersection operations (parking immediately adjacent to the intersections is eliminated through intersection buildouts under either alternative), the intersection LOS reported above for Alternative 2 also applies to Alternative 4. The summer intersection LOS results presented in Tables 34 and 35 apply to Alternative 4, as there is no difference in the intersection configuration between these two alternatives. In 2008, acceptable (LOS E or better) would be provided at all approaches to the Bear Street roundabout, and at the SR 267/SR 28 signal. However, LOS F conditions would occur on the eastbound approach to the Coon Street roundabout, with long queues. In 2028, both roundabouts would provide poor (LOS F) conditions on the SR 28 approaches. In addition, the SR 267/SR 28 signal would operate at LOS F, under the existing configuration.

### Post-Project Roadway Level of Service – 2008

The roadway LOS for Alternative 4 during the key summer season is the same as Alternative 2, since these alternatives only differ (from a traffic perspective) regarding the provision of on-street parking in the non-summer seasons. Tables 38 and 39, above, indicate the following for 2008 conditions:

- In the westbound direction, roadway capacity would be exceeded (resulting in the formation of slow-moving traffic queues along SR 28) during a total of 15 hours over the course of the summer. These hours would occur over five individual days, and up to 6 hours of traffic queues would occur on an individual day.
- In the eastbound direction, roadway capacity would be exceeded during 28 hours of the summer. These hours will occur over the course of 10 individual days. Up to 7 hours of queuing would occur on an individual day.
- There would be a few days with queuing (in one or both directions) around the Fourth of July holiday. The majority of the remaining days with queuing would occur in the last few weeks of July and first few weeks of August, largely on Fridays and Saturdays in the eastbound direction, and Sundays in the westbound direction.
- Under all of the hours in which congestion on SR 28 is forecast to occur, the diverted volume is expected to range to no more than 200 vehicles per hour.

- Eastbound traffic queues generated by the north Stateline pedestrian signal will not form back into Kings Beach at any time throughout the summer.
- In the eastbound direction, the TRPA LOS standard would be exceeded on ten days per year. In the westbound direction, the peak hour exceeds LOS E on five days, while the number of days per year with more than 4 hours exceeding LOS D is 4, indicating that the TRPA LOS standard is exceeded four days per year.

2008 Roadway LOS conditions for a peak winter day under Alternative 4 are presented in Table 40 and 41. As shown, one hour of LOS E would result in the eastbound direction and none in the westbound direction, with no hours of LOS F conditions in either direction. This attains the TRPA LOS standard.

#### Post-Project Roadway Level of Service – 2028

As presented in Tables 42 and 43, roadway LOS results in 2028 would be as follows:

- In the westbound direction, roadway capacity would be exceeded (resulting in LOS F and the formation of slow-moving traffic queues along SR 28) during a total of 774 hours over the course of the summer. These hours would occur over virtually all days of the summer, and up to 11 hours of traffic queues would occur on an individual day.
- In the eastbound direction, roadway capacity would be exceeded (LOS F) during 670 hours of the summer. These hours will occur over the course of 104 individual days. Up to 11 hours of LOS F queuing would occur on an individual day.
- As shown in Table 43, the days with a particularly high number of hours of queuing (in one or both directions) start around the Fourth of July holiday, and continue into mid-August.
- As shown in the central portion of Table 42, the diverted volume is expected to range up to between 400 and 500 vehicles per hour in the eastbound direction (for 124 hours per summer), and 500 to 600 vehicles per hour in the westbound direction (for 144 hours per summer).
- Eastbound traffic queues generated by the north Stateline pedestrian signal will form back into Kings Beach during 69 hours per summer. Subtracting this figure from the 670 total hours of eastbound queuing per summer, this roadway alternative in Kings Beach would generate 601 additional hours of queues over and above the 69 hours resulting from the north Stateline signal.
- The TRPA LOS standard has two criteria: whether the peak hour is LOS E or better, and whether no more than 4 hours per day exceed LOS D. In the eastbound direction, the peak hour exceeds LOS E on 104 days, while the number of days per summer with more than 4 hours exceeding LOS D is 92. Taking the higher of these two numbers, the TRPA LOS standard would be exceeded on 104 days per summer. In the westbound direction, the peak hour exceeds LOS E on 108 days, while the number of days per year with more than 4 hours exceeding LOS D is 105, indicating that the TRPA LOS standard is exceeded 108 days per summer.

LOS analysis of a peak winter day for Alternative 4 is presented in the right-hand portions of Tables 40 and 41. As shown in Table 40, absolute capacity would be exceeded during 3 hours in the eastbound direction, and ten hours in the westbound direction. In addition, LOS would be below LOS D for 6 hours eastbound and 11 hours westbound, as shown in Table 41. TRPA LOS standards would therefore be exceeded.

### Post-Project Traffic Volumes on Residential Streets – 2008 and 2028

Impacts during the peak summer season on residential street volumes for Alternative 4 are also identical to those of Alternative 2, as presented in Table 44. Alternative 4 is not forecast to generate significant increases in ADT on residential streets in 2008. However, by 2028, substantial ADT would be generated by diverted traffic, particularly on Fox Street between Minnow and Salmon (5,400 ADT), Fox Street between Brook and Trout (4,700 ADT), and Chipmunk Street between SR 28 and Minnow Avenue (4,000 ADT). Based on these results, it can be expected that many other residential street segments would also experience substantial increases in traffic levels due to diverted traffic in 2028.

### Post-Project Consistency with Traffic Signal Warrants – 2008 and 2028

The signal warrant analysis for Alternative 4 does not differ from that of Alternative 1, as shown in Table 32 and Table 33, for 2008 and 2028 conditions, respectively. All study intersections meet multiple warrants, in both 2008 and 2028.

### Summary of Significant Impacts

#### *Roadway LOS*

As a result of implementation of Alternative 4, there is the potential to exceed the TRPA standard of no more than 4 hours per day of LOS E on SR 28 in Kings Beach:

- In 2008, the TRPA LOS standard would be exceeded on ten days per summer in the eastbound direction, and five days per summer in the westbound direction. TRPA standards do not identify how many days per year or per season are required to be considered a significant impact. (As traffic studies typically do not evaluate multiple days per season, this issue is not typically raised.) Standard traffic engineering practice is to not establish significance based upon a single peak hour or peak day, but rather to consider a “typical peak” condition (such as the 30th-highest volume in a year). For a seasonal daily standard, the 10th-highest day is assumed to be applicable for purposes of this study. Based upon this, LOS impacts in 2008 in the eastbound direction are considered to be **significant**.
- In 2028, the TRPA LOS standard would be exceeded every one of the 108 days in the summer season in the westbound direction, and 104 days per summer season in the eastbound direction. In addition, the TRPA LOS standard would be exceeded in both directions on a peak winter day. This impact is considered **significant**.

#### *Residential Streets*

As a result of implementation of Alternative 4, there is the potential to exceed the standard of no more than 3,000 ADT on a residential street. This standard is not expected to be exceeded in 2008. However, by 2028 this standard is forecast to be exceeded on portions of Fox Street (up to 5,400 ADT) and Chipmunk Street (up to 4,000 ADT). This impact is considered **significant**.

#### *Intersection LOS*

The proposed single-lane configurations would provide unacceptable LOS F conditions on the worst (SR 28) approaches at Bear Street in 2008 and 2028, and at Coon Street in 2028. Long queues would form that would block other public street intersections along SR 28. In addition, the SR 267/SR 28 signalized intersection would provide unacceptable LOS F conditions in 2028. This would be a **significant** impact.

## Section 4

# Mitigation, Avoidance, Minimization, and Compensation Measures

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### Alternative 2

#### Mitigation for Roadway Level of Service – Alternative 2

As discussed extensively above, roadway volumes would exceed the capacity of a three-lane roadway as well as exceed TRPA LOS standards in 2008 on ten days per summer in the eastbound direction, five days per summer in the westbound direction, as well as in both direction on a peak winter day. Under 2028 conditions, LOS standards and roadway capacity would be substantially exceeded on virtually every day in the summer, as well as in the winter. Peak volumes would exceed capacity by over 100 vehicles per hour in 2008, and by over 300 vehicles per hour in 2028.

To address this deficiency, there are several possible mitigation strategies that merit discussion.

- Expansion of public transit services could potentially reduce traffic volumes. To address the deficiency, roughly 185 vehicles per hour would need to be removed in the peak direction in 2008 and 450 in 2028. Assuming an average vehicle occupancy of 2 persons per vehicle, this indicates that 370 transit passengers per hour would need to be served in 2008, and 900 in 2028. At an estimated maximum passenger load of 40 persons per bus, this would require 10 buses per hour in 2008 and 23 buses per hour in 2028 (over existing services) to provide adequate capacity. At present, existing funding sources limit the public transit program to only approximately 4 vehicle-trips per hour (including the local rubber-tired trolley program and expansion of summer TART service to half-hourly to be initiated in the summer of 2005), carrying on the order of 30 passengers per hour per direction during the mid-day period of peak traffic volume. In addition to the financial resources that would be required to operate an additional 10 to 23 vehicles per hour in each direction throughout the peak season, actually generating the necessary increase in ridership even if the service could be provided would undoubtedly require substantial auto use restrictions (such as roadway tolls or substantial parking fees). For this reason, this potential mitigation is considered to be infeasible.
- A new roadway could be constructed, effectively bypassing downtown Kings Beach by connecting SR 267 north of Kings Beach with SR 28 to the east. However, a new roadway of this magnitude is not consistent with TRPA's plans and policies, and is not feasible.
- The capacity of SR 28 could be improved, over and above the benefits of the elimination of on-street parking assumed in this alternative. To avoid exceeding capacity, roadway capacity would need to be increased by 16 percent in 2008 and 26 percent in 2028. Reviewing the capacity analysis presented in Table 36, this 2008 figure could be achieved for the critical roadway segments, but the 2028 figure is more than the total capacity reductions. Even for 2008 conditions, providing adequate capacity of a three-lane roadway would require elimination of virtually all driveway access, pedestrian/bicycle at-grade crossing, and bicycle travel along SR 28. As these restrictions are not consistent with the purpose and need of the proposed project as well as the function of the highway in providing property access, this potential mitigation is considered to be infeasible.

In summary, there are no feasible mitigations to address this impact. This impact is therefore considered to be significant and unmitigatable.

## Mitigation for Residential Traffic Volume Impact – Alternative 2

As summarized in Table 44, in 2028 the lack of adequate roadway capacity on SR 28 would result in the diversion of traffic onto residential streets in Kings Beach that exceeds the standards of significance. As discussed above, there are no feasible means of reducing traffic volumes in order to avoid this impact. Another potential measure that could address the impact on residential streets would be to modify the residential street network to discourage or eliminate through traffic. Several potential options were evaluated.

- One option would be to add Stop signs, speed humps, small traffic circles or other “traffic calming” devices to increase travel time through the residential streets so that no time benefit is provided over remaining on the state highways. A traffic calming plan would need to add 9 minutes of delay to the residential street route in order to eliminate through traffic in both directions. If it is assumed that a typical traffic calming device (such as a speed hump, traffic circle, or choker) adds 10 seconds of delay, each potential travel route through the street grid would need to face a driver with roughly 54 traffic calming devices (or roughly 4 per block). To address all of the potential cut-through routes, a total of roughly 250 such traffic calming devices would be required to cover the entire street grid. This strategy is therefore not feasible.
- Another approach would be to break up the through travel routes by selective street closings, or by changing streets into one-way segments, with the direction of travel alternating every two blocks. This could substantially lengthen the travel distance through the residential grid. At a 20 mph average travel speed, however, travel distance would need to be increased by 3.3 miles in order to eliminate through traffic. This would be roughly equivalent to forcing drivers to “double back” between SR 28 and Speckled Avenue three times. Even if successful in eliminating through traffic, this strategy would increase the traffic levels generated by local traffic (as each local trip would be substantially lengthened) and would probably result in traffic volumes on residential streets that exceed the standard. This approach is therefore also not feasible.
- A final strategy would be to simply eliminate all through travel routes on the residential street grid between SR 28 and SR 267. The simplest approach (as it would only require two street changes) would be to close Speckled Avenue and Dolly Varden Avenue just east of SR 267, either permanently or temporarily during peak seasons. All traffic into and out of the residential neighborhood would then be provided via SR 28. This would result in some increase in volumes on the north-south streets (including the truck traffic associated with the industrial uses along Speckled Avenue), but given the low level of traffic volumes on Speckled and Dolly Varden, this shift would not cause significant impacts on residential streets or on intersection LOS.

This program would also need to eliminate the use of the east-west streets as a means for westbound and eastbound drivers on SR 28 to avoid traffic queues. In particular, it can be expected that Trout Avenue from Deer Street and Rainbow Avenue from Secline Street would be used by eastbound drivers that are aware that the Coon Street roundabout would allow them to avoid all or most of the traffic queue on the state highway, as well as westbound drivers that would have a relatively simple right-turn movement back onto the highway. Smaller traffic control devices (such as speed humps, chokers or traffic circles) would probably not be appropriated, as they cause snow removal problems and would not provide enough travel delay to address the problem. A feasible strategy could consist of the following.

- Conversion of Trout Avenue from Bear Street to Deer Street to one-way eastbound.
- Conversion of Steelhead Avenue from Bear Street to Deer Street to one-way eastbound.
- Construction of a “diagonal diverter” in the Rainbow Avenue/Deer Street intersection, from the northwest corner to the southeast corner. This would be a substantial physical barrier that would require all approaching northbound traffic on Deer Street to turn left onto Rainbow Avenue westbound, and all southbound traffic on Deer Street to turn left onto Rainbow Avenue eastbound (and vice versa).
- Construction of a second diagonal diverter in the Golden Avenue/Deer Street intersection, from the southwest corner to the northeast corner, thereby requiring eastbound traffic on Golden Avenue to turn left onto Deer Street northbound.

This strategy would provide a shortest eastbound cut-through route for drivers leaving SR 28 at Secline or Deer that requires travel north to Loch Leven Avenue, which would increase travel time sufficiently to yield a longer travel time than staying on SR 28. Together, the two street closures, two street one-way conversions, and two diagonal diverters would eliminate the potential for significant cut-through traffic volumes.

However, by eliminating the ability of neighborhood streets to relieve traffic queues on SR 28, traffic queues and delays on the state highways would increase dramatically, as all drivers would then be forced to remain in the queues. These queues would accumulate over the entire period in which traffic volumes exceed roadway capacity. In 2008, eastbound queues approximately 0.1 miles in length would form on the average August Saturday. On the peak summer day, queues of roughly 5 miles would form. In the westbound direction, queues of only a few car-lengths would form on the average August Saturday, but queues of roughly 3 miles would form on the peak summer day. At an average speed of 6 miles per hour (based on observed travel speed through the Tahoe City queue), the average August Saturday peak hour delay would equal 1 minute in the eastbound direction and a few seconds in the westbound direction, but would reach as high as 48 minutes eastbound and 30 minutes westbound on the peak day.

By 2028, queue lengths would be on the order of 13 miles in both directions on the average August Saturday, and roughly 16 miles on the peak summer day, resulting in delays exceeding two hours. In reality, of course, many drivers faced with this level of delay would abort their trip, or change their travel time. However, delays would still remain very long. In short, the street modifications presented above could address the impact on residential streets, but only by significantly worsening the already-deficient conditions on the state highways. This potential mitigation measure is considered to be infeasible. The impact is therefore considered significant and unmitigatable.

#### Mitigation for Intersection Level of Service Impact – Alternative 2

With the proposed single-lane roundabouts, the SR 28/Bear intersection would provide LOS F conditions in 2028 and the SR 28/Coon intersection would provide LOS F conditions in 2008 and 2028. Analysis of roundabout geometry alternatives using the SIDRA software program indicates that adequate LOS (E or better) cannot be provided on these approaches barring expansion to a two-lane roundabout or provision of bypass lanes. Given the geometric constraints of the area, these potential mitigation measures are considered to be infeasible. The impact is therefore considered significant and unmitigatable.

In addition, with the existing lane configuration, the SR 28/SR 267 intersection would provide inadequate LOS F conditions in 2028. Providing a westbound right-turn lane at SR 28/SR 267 intersection would mitigate this impact to levels below the standard of significance.

### Alternative 3

#### Mitigation for Intersection Level of Service Impact – Alternative 3

With the existing lane configuration, the SR 28/SR 267 intersection would provide inadequate LOS F conditions in 2028. Providing a westbound right-turn lane at SR 28/SR 267 intersection would mitigate this impact to levels below the standard of significance.

### Alternative 4

#### Mitigation for Roadway Level of Service Impact – Alternative 4

As a result of implementation of Alternative 4, in 2008 the TRPA LOS standard would be exceeded on ten days per summer in the eastbound direction, and five days per summer in the westbound direction. In 2028, the TRPA LOS standard would be exceeded every one of the 108 days in the summer season in the westbound direction, and 104 days per summer season in the eastbound direction. In addition, the TRPA LOS standard would be exceeded in both directions on a peak winter day. As discussed above under Alternative 2, there are no feasible means of mitigating this impact. The impact therefore remains significant and unmitigatable.

#### Mitigation for Residential Street Traffic Volume Impact – Alternative 4

As a result of implementation of Alternative 4, standards for ADT volumes on residential streets are forecast to be exceeded on Kings Beach residential streets. As discussed above under Alternative 2, there are no feasible means of mitigating this impact. The impact therefore remains significant and unmitigatable.

#### Mitigation for Intersection Level of Service Impact – Alternative 2

With the proposed single-lane roundabout, the SR 28/Bear intersection would provide LOS F conditions in 2028 and the SR 28/Coon intersection would provide LOS F conditions in 2008 and 2028. Analysis of roundabout geometry alternatives using the SIDRA software program indicates that adequate (E or better) LOS cannot be provided on these approaches barring expansion to a two-lane roundabout or provision of bypass lanes. Given the geometric constraints of the area, these potential mitigation measures are considered to be infeasible. The impact is therefore considered significant and unmitigatable.

In addition, with the existing lane configuration, the SR 28/SR 267 intersection would provide inadequate LOS F conditions in 2028. Providing a westbound right-turn lane at SR 28/SR 267 intersection would mitigate this impact to levels below the standard of significance.

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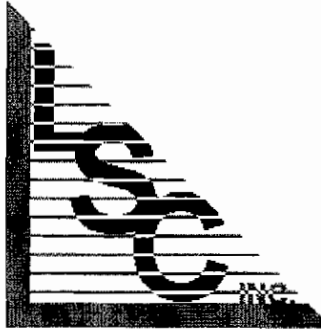
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## MEMORANDUM

DATE: December 7, 2006

TO: Jim Brake, Caltrans

CC: Ken Grehm & Dan LaPlante, Placer County DPW

FROM: Gordon Shaw, LSC

SUBJECT: Kings Beach Urban Improvement Project Revised Signal Warrant Analysis

The following discussion is intended to update the signal warrant analysis for the Kings Beach Urban Improvement Project Traffic Report, prepared by LSC Transportation Consultants, Inc. on September 7, 2006. This update is to respond to direction and comments provided by Jim Brake, Caltrans District 3, dated November 22, 2006, which incorporates changes to the California Manual on Uniform Traffic Control Devices (MUTCD), as adopted by Caltrans on September 26, 2006. After review and approval, this discussion will be incorporated into the next edition of the Project Traffic Report. Table numbering remains consistent with that of the Traffic Report, and tables not provided attached to this memo remain unchanged from the Traffic Report.

### Consistency with Traffic Signal Warrants – Alternative 1: No Project

A signal warrant analysis was conducted for the study area intersections for existing summer PM peak-hour design volumes, forecasted 2008 PM peak-hour design volumes, and forecasted 2028 peak-hour design volumes. As Caltrans has jurisdiction along SR 28, the signal warrant analysis is based upon Caltrans standards. While there are no adopted warrants for installation of a roundabout,

for purposes of this study the signal warrants are also assumed to be pertinent guidance regarding the placement of a roundabout, as both signals and roundabouts are intended as traffic control devices.

The *California Manual of Uniform Traffic Control Devices* (MUTCD) (Caltrans, September 26, 2006) is the current adopted document used by Caltrans to determine whether a signal is warranted. Caltrans' *Traffic Manual* (November, 1966, as revised) incorporates the MUTCD warrants as important elements in the decision to locate a new traffic signal, as follows:

*"The justification for the installation of a traffic signal at an intersection is based on the warrants stated in this Manual and in the Manual on Uniform Traffic Control Devices published by the Federal Highways Administration. The decision to install a signal should not be based solely upon the warrants, since the installation of traffic signals may increase certain types of collisions. Delay, congestion, approach conditions, driver confusion, future land use or other evidence of the need for right of way assignment beyond that which could be provided by stop signs must be demonstrated"* (page 9-1).

Eight warrants for traffic signals are cited in Section 4 of the California MUTCD. The specific values used in these warrants depend upon the characteristics of the study site. Site conditions for the SR 28 intersections are assumed as follows:

- The 85th percentile speed along SR 28 was assumed to be approximately 30 miles per hour.
- With the exception of the SR 267 / SR 28 intersection, none of the minor street approaches are striped with separated left, through, or right-turn lanes. However, the southbound approaches of Secline Street and Bear Street SR 28 approaches are relatively wide and are observed to be typically used as if there are separate right-turn lanes. Therefore, it was assumed that these approaches do have separate right-turn lanes in the LOS analysis, but were considered one-lane approaches for the warrant analysis.
- Warrants 1, 2, and 3 are all dependent on the highest volume minor street approach and the total through volume on the major street. As allowed in the September 2006 revisions to the California MUTCD, the left-turn movements from the state highway are included in the highest volume minor street approach figure, and subtracted from the major street through volume.
- To account for the effect of pedestrian crossing demand in the warrant analyses, the number of bicycles and pedestrians that cross the highway at each is also added into the highest volume minor street approach volume.
- The study area is also considered to be in "an isolated community having a population of less than 10,000", which allows for warrant threshold volumes that are 70% of the normal values in Warrants 1, 2, and 3.
- While signal warrant analyses are generally based upon "typical" traffic levels, rather than the relatively high design volumes used in other portions of this analysis, Caltrans has

indicated that a 30<sup>th</sup>-highest peak-hour level of traffic activity is appropriate for this specific analysis, in light of the relatively high accident rate and level of pedestrian activity in the corridor. The design-hour volumes for the state highways shown in Table 7 were therefore used as the basis for this warrant analysis.

- It is also necessary to estimate fourth-highest and eighth-highest volumes for some of the warrants. Estimates of the fourth-highest and eighth-highest peak-hour volumes based upon available hourly count data. To do this, hourly count data between June 2, 2002 and September 30, 2002 along SR 28 just east of SR 267 was reviewed. On busy days, the 4th-highest peak-hour volume was approximately 87 percent of the peak-hour volume and the 8th-highest peak-hour volume was approximately 70 percent of the peak-hour volume along SR 28. Therefore, it was assumed, for example, that the 4th-highest peak-hour volume per day on the SR 28 approaches were 80 percent of the design peak-hour volume shown in Table 7. However, in 2028 traffic volumes on SR 28 will be more consistent over a longer period of the day, due to capacity constraints. For the SR 28 through volumes, analysis of the hour-by-hour data for the average Saturday in August indicates that the 4th-highest peak-hour volume will be equal to the peak-hour, while the 8th-highest peak-hour volume will be 95 percent of the peak hour.
- As eight hours of count data is available at the Secline Street, Deer Street, Bear Street, and Fox Street intersections, the 4th-highest and 8th-highest peak-hour approach volumes on the minor street approaches were estimated by multiplying the ratio of the 4th- and 8th-highest volumes to peak-hour volumes as determined from the raw traffic count data by the design volumes. The four-hour and eight-hour turning-movement volumes at the Coon Street, and Chipmunk Street intersections were estimated assuming that the traffic variation along these side streets is equal to the average side street volume variation of the intersections for which there is data (Secline, Deer, Bear, and Fox). The variation of traffic on SR 267 was assumed to equal the variation of traffic on SR 28. The 2002 four-hour and eight-hour volume data is presented in Table 29.
- Accident data is available from 1997 through 2004 at each intersection, as shown in Table 16.
- Pedestrian count data is available for the following locations and time periods:
  - SR 267 / SR 28, January 4, 2003, 8:00 AM to 5:50 PM
  - SR 28 / Secline Street, July 31, 1999, 9:00 AM to 5:00 PM
  - SR 28 / Deer Street, August 21, 1999, 8:15 AM to 4:15 PM
  - SR 28 / Bear Street, July 10, 1999, 8:00 AM to 4:00 PM
  - SR 28 / Fox Street, August 21, 1999, 8:00 AM to 4:00 PM

However, no pedestrian count data is available at Coon Street or Chipmunk Street. Informal observation by LSC staff indicates the pedestrian crossing activity is relatively high at Coon Street (at least equal to Bear Street) but relatively low at Chipmunk Street.

Note that this warrant analysis focuses on summer conditions only; as peak winter conditions are relatively infrequent, it is common to not base traffic signal warrants in the Tahoe Region solely on

winter conditions. Based upon these assumptions and the additional data presented in Table 29, the results of the signal warrant analysis for the existing conditions are summarized in Table 30, as follows:

**Warrant 1: Eight-Hour Vehicular Volume:** *Based upon the estimated eight-hour traffic volumes, this warrant is met for all study intersections.*

**Warrant 2: Four-Hour Vehicular Volume:** *This warrant is met at all study intersections.*

**Warrant 3: Peak-Hour:** *This warrant is met at all study intersections.*

**Warrant 4: Pedestrian Volume:** *Although data regarding the number of gaps in traffic present on SR 28 is not available, this warrant is probably met at the SR 28 / Bear Street and SR 28 / Coon Street intersections based upon available pedestrian count data.*

**Warrant 5: School Crossing:** *As there are no established school crossings along SR 28 in Kings Beach, this warrant is not potentially applicable to any of the SR 28 study intersections.*

**Warrant 6: Coordinated Signal System:** *This warrant is not applicable to SR 28 in Kings Beach.*

**Warrant 7: Crash Warrant:** *SR 28 / Deer Street was the only intersection along SR 28 that reported an average accident rate per year approaching the warrant value, though the ability to remedy these accidents cannot be determined. Regardless, the intersection does not meet the corresponding volume requirements. Therefore, this warrant is not met at any of the SR 28 study intersections.*

**Warrant 8: Roadway Network:** *This warrant is met at the SR 28 / SR 267 intersection only.*

In total, three warrants are met at the Secline, Deer, Fox and Chipmunk Street intersections, while four warrants are met at the SR 267, Bear, and Coon intersections. It should be noted that satisfaction of one or more warrant does not necessarily indicate that a signal should or must be provided. As stated in Section 4C.01 of the California MUTCD, *“The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.”*

#### Signal Warrant Analysis – 2008 Conditions: Alternative 1 Without Project

The 2008 signal warrant analysis was based upon the 2008 30th highest peak-hour volumes. Through volumes on SR 28 were increased by the highest annual average growth rate observed at any one point along SR 28 in the study area between 1991 and 2001 (0.31 percent per year, observed east of Coon Street). No growth in side street volumes was assumed.

Additional volume data used in the analysis may be found in Table 31, while the results of the analysis are shown in Table 32. As Table 32 indicates, the same signal warrants are met under the 2008 conditions as are met under the existing conditions, largely because the 2008 design volumes are relatively similar to existing volumes. The signal warrant analysis therefore indicates that three to four warrants are met for a signal or roundabout at all study intersections.

Signal Warrant Analysis – 2028 Conditions: Alternative 1 Without Project

The 2028 signal warrant analysis results are shown in Table 33. For 2028 conditions, the following intersections are found to meet signal warrants:

- **SR 28 / SR 267:** Eight-Hour Vehicular Volume Warrant, Four-Hour Vehicular Volume Warrant, Peak Hour Warrant, and Roadway Network Warrant.
- **SR 28 / Secline Street, SR 28 / Deer Street, SR 28 / Fox Street, SR 28 / Chipmunk Street:** Eight-Hour Vehicular Volume Warrant, Four-Hour Vehicular Volume Warrant, and Peak Hour Warrant.
- **SR 28 / Bear Street, SR 28 / Coon Street:** Peak Hour Warrant, Four-Hour Vehicular Volume Warrant, Peak Hour Warrant and Minimum Pedestrian Volume Warrant.

Alternative 2: Post-Project Consistency with Traffic Signal Warrants – 2008 and 2028

The signal warrant analysis for Alternative 2 does not differ from that of Alternative 1, as shown in Table 32 and Table 33, for 2008 and 2028 conditions, respectively.

Alternative 3: Post-Project Consistency with Traffic Signal Warrants – 2008 and 2028

The signal warrant analysis for Alternative 3 does not differ from that of Alternative 1, as shown in Table 32 and Table 33, above, for 2008 and 2028 conditions, respectively.

Alternative 4: Post-Project Consistency with Traffic Signal Warrants – 2008 and 2028

The signal warrant analysis for Alternative 4 does not differ from that of Alternative 1, as shown in Table 32 and Table 33, above, for 2008 and 2028 conditions, respectively.

**Table 29: Additional Data Used in Existing SR 28 Signal Warrant Analysis**

SR 28 @	Peak-Hour			Estimated 4-Hr Volume		Estimated 8-Hr Volume		Average Number of Accidents per Year (1997 through 1999)		
	Major Street Approach Volume Total of Both Directions - Higher SR 28 LT Volume	Volume on higher-volume approach + higher SR 28 LT Volume	Bike & Ped Volume Crossing SR 28	Major Street Approach Volume		Major Street Approach Volume				
				Total Minor Approach + Higher SR 28 LT + Bike / Ped Crossing	Total of Both Directions - Higher SR 28 LT Volume	Total Minor Approach + Higher SR 28 LT + Bike / Ped Crossing	Total of Both Directions - Higher SR 28 LT Volume			
267	1,935	790	40	830	1,683	747	1,355	664	34	3.8
Secline	2,272	100	20	120	1,977	108	1,590	96	35	3.9
Deer	2,254	60	58	118	1,961	106	1,578	94	44	4.9
Bear	2,165	157	145	302	1,884	272	1,516	242	22	2.4
Coon	2,038	281	100	381	1,773	343	1,427	305	28	3.1
Fox	1,999	137	46	183	1,739	165	1,399	146	36	4.0
Chipmunk	1,923	71	10	81	1,673	73	1,346	65	11	1.2

Source: LSC Transportation Consultants, Inc.

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**Table 30: Existing Conditions Signal Warrant Analysis**

SR 28 @	Warrant 1		Warrant 2	Warrant 3		Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8	Number of Warrants Met
	Condition A - Minimum Vehicle Volume	Condition B - Interruption of Continuous Traffic	Four Hour Volumes	Part A - Peak Hour Delay	Part B - Peak Hour Volume	Minimum Pedestrian Volume	School Crossings	Coordinated Signal System	Crash Warrant	Roadway Network	
SR 267	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	Yes	4
Secline Street	No	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	No	3
Deer Street	No	Yes	Yes	No	Yes	No	No	Not Applicable	No	No	3
Bear Street	Yes	Yes	Yes	No	Yes	Yes	No	Not Applicable	No	No	4
Coon	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	4
Fox Street	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	No	3
Chipmunk Street	No	Yes	Yes	No	Yes	No	No	Not Applicable	No	No	3

Source: LSC Transportation Consultants, Inc.

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**Table 31: Additional Data Used in 2008 and 2028 SR 28 Signal Warrant Analysis**

SR 28 @	Peak-Hour			Estimated 4-Hr Volume			Estimated 8-Hr Volume		
	Major Street Approach Volume Total of Both Directions - Higher SR 28 LT Volume	Volume on higher-volume approach + higher SR 28 LT Volume	Bike & Ped Volume Crossing SR 28	Total Minor Approach + Higher SR 28 LT + Bike / Ped Crossing	Major Street Approach Volume Total of Both Directions - Higher SR 28 LT Volume	Total Minor Approach + Higher SR 28 LT + Bike / Ped Crossing	Major Street Approach Volume Total of Both Directions - Higher SR 28 LT Volume	Total Minor Approach + Higher SR 28 LT + Bike / Ped Crossing	
<b>2008 Volume Data</b>									
267	1,955	815	40	855	1,701	770	1,369	684	
Secline	2,270	100	20	120	1,975	108	1,589	96	
Deer	2,261	60	58	118	1,967	106	1,583	94	
Bear	2,182	136	145	281	1,898	253	1,527	225	
Coon	2,006	302	100	402	1,745	362	1,404	322	
Fox	1,991	137	46	183	1,732	165	1,394	146	
Chipmunk	1,926	71	10	81	1,676	73	1,348	65	
<b>2028 Volume Data</b>									
267	2,713	1,607	40	1,647	2,360	1,482	1,899	1,318	
Secline	3,301	128	20	148	2,872	133	2,311	118	
Deer	3,276	100	58	158	2,850	142	2,293	126	
Bear	3,178	240	145	385	2,765	347	2,225	308	
Coon	2,980	353	100	453	2,593	408	2,086	362	
Fox	2,901	209	46	255	2,524	230	2,031	204	
Chipmunk	2,814	116	10	126	2,448	113	1,970	101	

Source: LSC Transportation Consultants, Inc.

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**Table 32: 2008 Conditions Signal Warrant Analysis -- All Alternatives**

SR 28 @	Warrant 1		Warrant 2	Warrant 3		Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8	Number of Warrants Met
	Condition A - Minimum Vehicle Volume	Condition B - Interruption of Continuous Traffic	Combination	Four Hour Volumes	Part A - Peak Hour Delay	Part B - Peak Hour Volume	Minimum Pedestrian Volume	School Crossings	Coordinated Signal System	Crash Warrant	
SR 267	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	Yes	4
Secline Street	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	3
Deer Street	Yes	Yes	Yes	Yes	No	Yes	No	Not Applicable	No	No	3
Bear Street	Yes	Yes	Yes	Yes	No	Yes	Yes	Not Applicable	No	No	4
Coon	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	4
Fox Street	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	3
Chipmunk Street	No	Yes	No	Yes	No	Yes	No	Not Applicable	No	No	3

Source: LSC Transportation Consultants, Inc.

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Table 33: 2028 Conditions Signal Warrant Analysis – All Alternatives													
SR 28 @	Warrant 1			Warrant 2		Warrant 3		Warrant 4	Warrant 5	Warrant 6	Warrant 7	Warrant 8	Number of Warrants Met
	Condition A - Minimum Vehicle Volume	Condition B - Interruption of Continuous Traffic	Combination	Four Hour Volumes	Part A - Peak Hour Delay	Part B - Peak Hour Volume	Minimum Pedestrian Volume	School Crossings	Coordinated Signal System	Crash Warrant	Roadway Network		
SR 267	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	Yes	4	
Secline Street	Yes	Yes	Yes	Yes	No	Yes	No	No	Not Applicable	No	No	3	
Deer Street	Yes	Yes	Yes	Yes	No	Yes	No	No	Not Applicable	No	No	3	
Bear Street	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	4	
Coon	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Not Applicable	No	No	4	
Fox Street	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Not Applicable	No	No	3	
Chipmunk Street	Yes	Yes	No	Yes	Yes	Yes	No	No	Not Applicable	No	No	3	
Source: LSC Transportation Consultants, Inc.													
KB Signal Warrant.wb3													